RAILROAD GAZETTE

FRIDAY, OCTOBER 9, 1896.

CONTENTS

ILLUSTRATIONS: PAGE.
A New Baldwin Locomotive for the Lehigh Valley Railroad..... 696
The Proposed Chesapeake & Ohio Improvements at Richmond, Va..... 698
New Brooks Locomotive for the Erie..... 701
A 100-Per Cent. Rail Joint. 702
The Webb and Thompson Train-Staff Apparatus.... 702

CONTRIBUTIONS:
Elevation on Sharp and on Flat Curves..... 695

EDITORIALS:
The Railroads of the United States in 1895..... 704
Signal Rules for Trains Approaching Crossings..... 705
British Railroad Statistics in 1895..... 706
Annual Reports—New York Central & Hudson River..... 706
EDITORIAL NOTES.....704, 706
Trade Catalogues..... 706

GENERAL NEWS:
Bridge Building..... 709
Railroad Law..... 709
Meetings and Announcements..... 710
Personals..... 710
Elections and Appointments..... 710
Railroad Construction.... 711
Electric Railroad Construction..... 711
General Railroad News.... 711
Electric Railroad News.... 712
Traffic..... 712

MISCELLANEOUS:
Technical..... 707
The Scrap Heap..... 708
Some Effects of the Atlantic Coast Storm..... 695
Present Status of the Distribution and Transmission of Electrical Energy 697
Mr. J. T. Brooks on Sound Money..... 701
Some Elevated Railroad History..... 703
An Electric Motor on the Manhattan Elevated... 707
Asbestos..... 707

Contributions.

Elevation on Sharp and on Flat Curves.

PORT JERVIS, N. Y., Sept 29.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your correspondent Mr. C. Frank Allen, Sept. 25, has suggested an increase of elevation in the light curves and a reduction in the sharp ones, for the reason that the engineer would reduce his speed on the sharp curves and increase his speed on the light ones. I must differ slightly with him in this matter. The more uniform rate of speed at which the engineer runs the more pleasant it is to all concerned, and the better for the machine he runs, and if you can aid him by elevating the greatest curves all that is advisable, he will be able to haul his train at a more uniform rate of speed.

If all trains ran at one rate of speed the curve problem could easily be solved, but while one train runs fast and another slow, the elevation must be divided so as to meet half way the requirements of each. Consequently the greater curves do not have sufficient elevation for high speed, and the engineer is compelled to hold his train on such curves from a standpoint of necessity instead of doing so from his own choice.

Light curves always seem to be elevated sufficiently at any rate of speed, and they seem so much like a tangent that they are hardly worthy of mention.

It has been my privilege for the last 30 years to note the changes made by roadmasters in the elevation of curves, and to note the improvements that are brought into execution by the roadmasters of the Delaware Division of the Erie Railroad, of which I am an employee; and I am led to think that while the world is constantly getting better, the roadmasters are keeping pace with it.

MERITT TURNER,
Road Foreman of Engineers, Erie Railroad.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Prof. C. Frank Allen states that in the table recommended by the Roadmasters' Association, and published by you on Sept. 11, "the results are obtained by a formula in which the speed is constant." It seems to me that if Mr. Allen will examine that formula once more, he will find that the only constant used is the acceleration of gravity, and that the speed, or velocity, is represented by (v), which is then necessarily a variable, and which changes the value of the formula in accordance with the train speed. The formula, as given, certainly provides for any and all variations in speed.

In regard to the table which is stated by the Road Masters' Committee as being computed by the beforementioned formula, I venture to say that several mistakes have been made in its preparation. Its accuracy has been tested by substituting the values indicated in the formula and then working out the results, and in several cases considerable variation is noted between the results found and those given by the committee, being in one case as great as 0.5 in. These test calculations were carefully made, and the work gone over several times.

There is little doubt that rails should be elevated for the highest speeds at which trains are run over the curves, and in the case of very sharp curves it might be found safe and economical to considerably reduce the elevation, and would also make much easier and smoother running for the slower trains.

W. T. STEVENS.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to the remarks of Prof. C. Frank Allen in the *Railroad Gazette* of Sept. 25, relative to the matter of elevation of outer rail on curves, his question as to the relevancy of the table recently prepared by a committee of the Roadmasters' Association seems very pertinent. . . . Taking the case of roads having curves as high as 16 deg., it is certainly not good practice to make the elevation proportional to the degree of curve.

On a number of railroads of this character a usual rule is to make the elevation ½ in. per degree, which corresponds to a speed a trifle over 30 miles an hour. Where the time-table speed is about 25 miles an hour, and with not too many stops, 30 miles an hour I suppose fairly represents the maximum speed between stations.

Speaking from my own experience and observation, I know it to be the practice (it would be stating it too strongly, perhaps, to say the universal practice) of enginemen to regulate the running speed according to the sharpness of the curvature. . . .

Let us take the case of a 10-deg. curve where a speed of 30 miles an hour requires an elevation of 6 in., while at 20 miles an hour the necessary elevation is only 2½ in., a very marked difference. Where the curvature varies in sharpness it is very likely that that the engineman will be more apt to run at speed of 40 miles an hour over the lighter, and 20 miles an hour over the sharper curves, than at uniform speed of 30 miles over all curves.

I fully understand the difficulty of making a hard and fast rule to fit all exigencies and conditions, but for the purpose of exciting discussion of what seems a rational proposition, I would suggest that for roads of the character mentioned a rule elevating track for 40 miles an hour, up to a maximum of say 4 in. This would represent a speed of 30 miles an hour on curves between 4 deg. and 7 deg., 25 miles an hour on curves between 7 deg. and 10 deg., and 20 miles an hour on curves between 10 deg. and 15 deg.

The main difficulty in enforcing an arrangement of this kind would be the want of knowledge on the part of the enginemen as to the danger of curvature. This could be readily overcome by suitable marking boards on which the degree was painted in large figures.

W. O. LÉLIME.

Erie Railroad Company,
NEW YORK, Sept. 29, 1896.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Prof. C. Frank Allen's reasoning to account for the statement made to him by the section foreman, "that in his judgment, it was common to elevate the outer rail too much on sharp curves, and not enough on flat curves," is very ingenious; it is natural to a man who, as a student, thinks more correctly what other men should do under certain circumstances, than what they actually do do.

It would, undoubtedly, be very good practice on the part of the engineman to somewhat regulate his speed according to the alignment over which he runs, and I heard of such a case on my recent trip, where one sensible and experienced engineman did so, not by changing his throttle to take in or cut off steam, but by a judicious use of the air-brake. However, the great majority of enginemen running on a fixed schedule will pay no attention to the degree of curvature, and will run at a uniform speed as nearly as possible, unless they are cautioned by special orders, or have learned by experience that it is wise to reduce speed at certain curves.

It would, therefore, be impracticable to enforce, with any degree of accuracy, the running of locomotives at variable speeds over a number of curves differing in the length of their radii. The matter must be left to the experience and judgment of the man running the locomotive, and the civil engineer can only fix the elevation of the outer rail upon definite assumption, based upon every-day facts.

I believe the practice recommended by the Committee of the Roadmasters' Association, as published in the *Railroad Gazette* of Sept. 11, is correct. The elevation of the outer rail of 7 in. should never be exceeded, as it is dangerous to run at a speed over a curve so sharp that it demands an elevation higher than that.

CHAS. W. BUCHHOLZ. *Chief Engineer.*

Burlington, Cedar Rapids & Northern Railway,
CEDAR RAPIDS, Ia., Sept. 26, 1896.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Mr. Allen is in error when he states that the table of elevations given in your issue of Sept. 11 is "obtained by a formula in which the speed is constant." V^2 of the formula may be any rate of speed whatever, and the table shows speed of 10, 20, 30, 40, 50, 60 and 70 miles per hour. No one will claim that all curves of same radius should have same elevation.

The rate of speed for each curve is a matter of judgment and observation, and directly determines the amount of elevation.

It is a fact that careful engineers will slow down somewhat for sharp curves and run at full speed over the light ones and the table shows that for very high speed the limit of elevation is soon reached and the necessity of reducing speed is apparent. My experience is that the formula is correct.

GARRET DAVIS, *Division Engineer.*

TO THE EDITOR OF THE RAILROAD GAZETTE:

In my judgment the section foreman referred to by Mr. Allen was about correct. We start in by elevating in accordance with the rule of our own instructions, and, if necessary, elevating more or less—usually more, seven inches being the maximum—after riding over the curve on trains of different speeds. Whether or not the engineman always reduces the speed in rounding a curve—though probably he does slightly apply the air-brake in order to stiffen the train, if he knows the curve rides badly—the speed is reduced by the retarding effects of the curvature itself. For the purpose of properly elevating a particular curve, one can easily find out what the maximum speed at such a curve is, and elevate accordingly.

After all that may be said, however, the question of the proper elevation of the outer rail for a mixed traffic is a hard one to decide. Take a traffic where one train consists of 90 cars of coal weighing 3,500 tons, and running at a speed of 20 miles an hour, another train with fast freight weighing 1,500 tons, and running 35 miles an hour, and sandwiched in, the "Chicago Limited," of 6 to 10 sleepers, running as fast as it can turn a wheel, and you have a problem in elevation which all the theory in the world and a good deal of practice will not solve. If you elevate for one class of traffic you do not accommodate the other classes. The lack of regularity in elevation is to my mind, the greatest source of trouble from curves. Especially is this true of the ends of curves. If a train goes on and off a curve without much jar the trouble from improper elevation is not so great, and it is much more lessened if the elevation is regular, even if less than the calculated amount. I do not believe in changes of elevation at every slight change of curvature in a compound curve. Of course where the change in curvature is considerable, say 2 deg. or 3 deg., change in the amount of elevation is required, but when such intermediate changes are made the curves should be eased—"spiraled," as we would say—between the two parts of the curve.

It may not be amiss to give you our method of putting up curves. All above 2 deg. have spiral easement curves at the ends, and in all compound curves where the changes are 2 deg. or more, the compound points are eased by spiraling between the two arcs. We use the Holbrook method of easement (*Railroad Gazette*, Dec. 3, 1880). A 60-ft. spiral is generally used—one increasing a minute per foot—the elevation of the outer rail, beginning at the zero end of spiral, becoming maximum at the point where spiral and circle join. The compound points are eased by connecting the two arcs with a spiral of the same kind, the length of which of course depends on the degree of curvature of the arcs to be connected. Opposite the zero point and opposite the point where spiral and circle join are placed posts, for the guidance of the trackmen in elevating the outer rail. The figure 0 is placed on the post opposite the zero point of the spiral, and the figure representing the full amount of elevation is placed on the post opposite the point where spiral and circle join. Posts with the elevation shown thereon are also placed at each end of spirals at compound points.

It may further interest you to know that on the New England road some years ago I applied the Holbrook spiral to easing the reversing points of reverse curves.

SUPERINTENDENT.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I think Mr. Allen has struck the keynote when he refers to varying speeds, as being the cause of the variety of opinions received from different roadmasters and other practical trackmen in regard to proper elevation of outer rail. The variations of speed are not proportional to the variations of degree of curve, and, in fact, follow no fixed rule. A road with a great variety of sharp curves, may find that the enginemen alter their speed, according to the curve. On the other hand, a road with easy curves, as the New Haven, may use a sharp curve occasionally, and enginemen will pay no attention in their speed, to the difference. I have in mind the curve at Port Chester. All other curves average, say, 2 deg. and are run at full speed. This is considerably sharper and is also run at full speed, and when I last rode over it, needed more elevation instead of less. I do not know, however, how much had already been given to it.

The grades, whether up or down and how steep, would also influence the results; a down grade requiring more, as a rule, than upgrade.

ENGINEER.

Some Effects of the Atlantic Coast Storm.

The storm of Sept. 29 was very wide in extent, and caused much loss of life and damage to property, especially to railroad property in the South. The *Philadelphia Press* estimates the total loss of life to be 200, one-half of which occurred on the islands on the coast, 50 in Florida, and the remainder distributed throughout the South. The total loss of property was estimated at $6,767,500, of which Pennsylvania suffered $1,993,500. A list follows of some of the more important railroad casualties:

In Pennsylvania: The covered wooden bridge of the Pennsylvania Railroad over the Susquehanna River at Columbia was blown from its piers into the river and completely wrecked. The bridge of the Pennsylvania Railroad at Henrietta was washed away. At Catawissa, the roof of the Philadelphia & Reading bridge over the Susquehanna River was carried away, and one span of the carriage bridge was blown into the river. At Wyalusing, the iron bridge crossing the Susquehanna was wrecked.

In Maryland: On the Norfolk & Western, many wash-

outs occurred along the line, and several bridges were destroyed, the largest being at Elkins.

In Virginia: One-half of the Norfolk & Western bridge over the Susquehanna at Riverton was destroyed.

In West Virginia: On the Cumberland & Pennsylvania Railroad several miles of roadbed and many trestles were washed away. On the Berkeley Springs branch of the Baltimore & Ohio all of the bridges were destroyed between Hancock & Berkeley Springs.

In Georgia: At Savannah, the passenger depot and other buildings of the Plant System were badly wrecked, and the freight warehouses of the Georgia & Alabama railroad were damaged.

In Florida: Several miles of roadbed and much trestling on the Florida Central & Peninsular railroad were washed away. The drawbridge of the Tybee Railroad over St. Augustine Creek was badly twisted and thrown on one side.

COLUMBIA BRIDGE.

The bridge over the Susquehanna River at Columbia, Pa., was struck by the hurricane and swept from its piers into the river. The whole structure is completely wrecked with the exception of two iron spans and a short span over the canal at the Columbia end. The bridge was a covered wooden structure, built by the Pennsylvania Railroad, and used by the Frederick Division and also as a public wagon road. It consisted of 28 spans of about 200 ft. each from center to center of piers, giving a total length of something over a mile. During the war, the bridge on the same site was burned by the inhabitants of Columbia as a military necessity; and in 1868, when the structure just wrecked was built at a cost of about $150,000, one of the center spans was replaced by two shorter spans of iron as a fire guard. The loss of the bridge interrupts direct traffic between Philadelphia, York and Frederick, but this service is supplied by making a detour via Harrisburg. There is a steam ferry above the dam south of the bridge at Columbia which answers for local traffic.

A New Baldwin Locomotive for the Lehigh Valley Railroad.

Five new fast passenger engines have recently been completed by the Baldwin Locomotive Works for the Lehigh Valley Railroad, one of which is shown by the accompanying illustrations. These locomotives were designed under the direction of the Superintendent of Motive Power of the Lehigh Valley road for service with the "Black Diamond Express." The perspective view from a photograph (Fig. 1) shows their external peculiarities.

The weight on the drivers is 81,800 lbs. and the total weight in working order is 140,950 lbs. The cylinders are 19 in. by 21 in. The total heating surface is 2,230 sq. ft. and the grate area is 63.9 sq. ft. The grate of the firebox is made of steel and is of the Lehigh Valley Standard (longitudinal) type with rocking bars and arranged for burning hard coal.

The boiler is of the radial stay, with firebox type, carrying 180 lbs. steam pressure and the driving wheels are 76 in. in diameter, with cast-steel centers. The tank of the tender is made of steel sheets of ¼ and $\frac{3}{16}$ of an inch in thickness. A rigid bolster truck with a four-wheel square wrought iron frame, having a steel underframe, is used.

The fulcrum for the equalizer between the back drivers and trailing wheels, as shown in Fig. 2, has been changed in some or all of the engines so as to throw more weight on the trailing wheels. The following are some of the principal dimensions, and the makers of the special material, entering into the construction of the engine:

General Dimensions.

Wheel base, total, of engine	24 ft. 0 in.
" " driving	6 ft. 7 in.
" " rigid	13 ft. 0 in.
" " total (engine and tender)	51 ft. 11 in.
Length over all, engine	38 ft. 3½ in.
" " " total, engine and tender	61 ft. 9½ in.
Height, center of boiler above rails	8 ft. 8 in.
" of stack above rails	14 ft. 8 in.
Heating surface, firebox	148.98 sq. ft.
" " tubes	2,081.24 sq. ft.
" " total	2,230.22 sq. ft.
Grate area	63.97 sq. ft.

Wheels and Journals.

Drivers, number	4
" diameter	76 in.
" material of centers	cast steel
Truck wheels, diameter	36 in.
Trailing wheels, diameter	55 in.
Journals, driving, axle size	8½ × 11 in.
" truck " "	5½ × 9 in.
" trailing axle	7 × 12 in.
Main crank pin, size	5½ × 5½ in.
Parallel rod pins, size...Back, 6½ × 4¼ in.; front, 4¼ × 4¾ in.	
Crosshead pin, size	3 × 3 in.

Cylinders.

Cylinders, diameter	19 in.
Piston, stroke	26 in.
" rod, diameter	3½ in.
Main rod, length center to center	10 ft. 3 in.
Steam ports, length	19 in.
" " width	1⅜ in.
Exhaust ports, length	19 in.
" " width	3¼ in.
Bridge, width	1⅛ in.

Valves.

Valves, kind of	Richardson balanced
" greatest travel	5¾ in.
" outside lap	1⅛ in.
" inside lap or clearance	$\frac{1}{16}$ in.
" lead in full gear	$\frac{3}{32}$ in.
" constant or variable	Variable

Boiler.

Boiler, type of	Radial stay, wide firebox
" material in barrel	Steel
" thickness of material in barrel	$\frac{9}{16}$ in.
" diameter of barrel at front sheet	61 in.
Seams, kind of, horizontal	Butt double-cover strip
" " circumferential	Double riveted lap
Thickness of tube sheets	½ in.
" crown sheet	⅝ in.
Crown sheet stayed with	Radial stays
Dome, diameter	30 in.

Tubes.

Tubes, number	265
" material	Iron
" outside diameter	2 in.
" length over sheets	15 ft. 1 in.

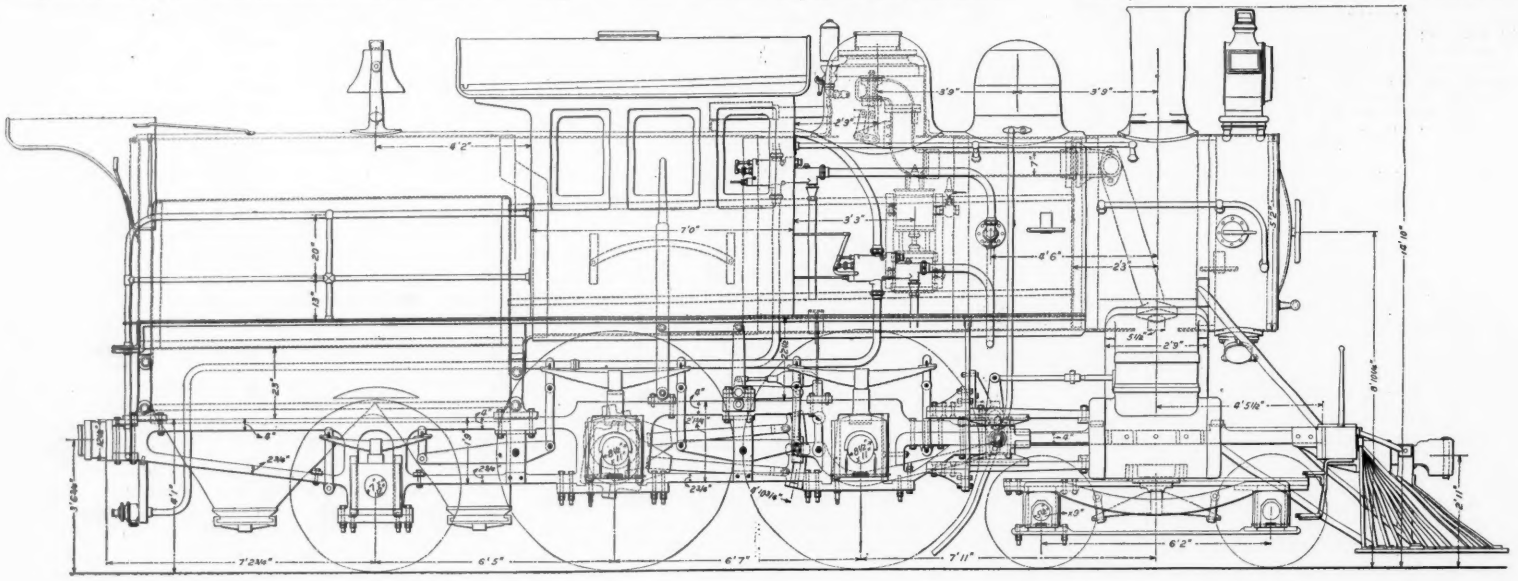


Fig. 2.

Side Elevation.

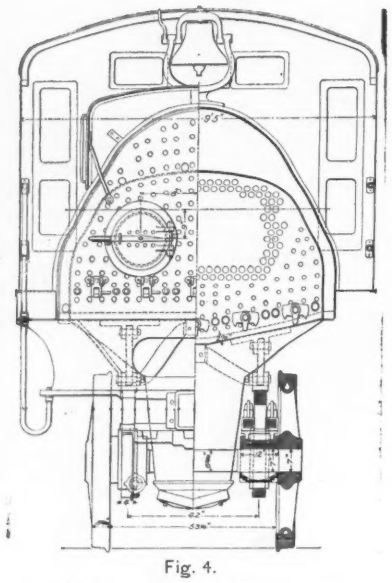


Fig. 4.

Back End Elevation. *Section through Firebox.*

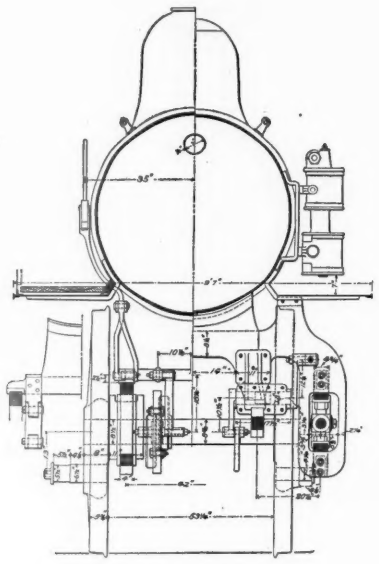


Fig. 5.

Sections Back of Cylinder.

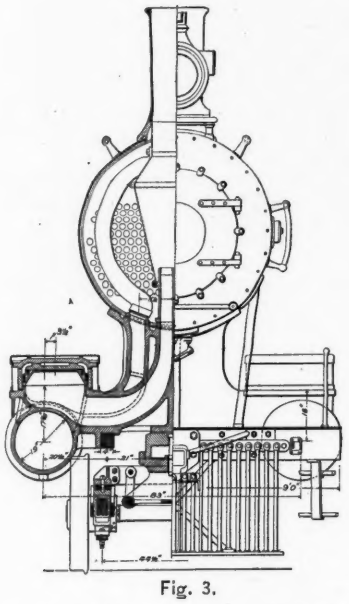


Fig. 3.

Cross Section through Cylinders. *Front End Elevation.*

DETAILS OF WIDE FIREBOX PASSENGER ENGINE—LEHIGH VALLEY RAILROAD.

Firebox.

Firebox, length	9 ft. 6⅝ in.
" width	6 " 8⅜ "
" depth, front	46¼ "
" " back	46¼ "
" thickness of sheets	⅜ and $\frac{5}{16}$ "
" water space, width; front, 4 in.; sides, 3½ in.; back, 3½ in.	

Smokebox.

Smokebox, diameter inside	61 in.
" length from tube sheet to end	65¾ "

Other Parts.

Exhaust nozzle, single or double	Low double
" " variable or permanent	Permanent
" " diameter	9 in.
" " distance of tip below center of boiler	11¼ "
Netting, wire or plate	No. 13 wire
" size of mesh	3 × 3 in.
Stack, straight or taper	Taper
" least diameter	15¾ in.
" greatest diameter	17½ "
" height above smokebox	3 ft. 4½ "

Tender.

Type	Swivel trucks
Tank capacity for water	4,000 gals.
Coal capacity	5½ tons.
Type of truck spring	Semi-elliptic
Diameter of truck wheels	36 in.
Diameter and length of axle journals	4¼ × 8 "
Distance between centers of journals	6 ft. 3 "
Diameter of wheel fit on axle	5⅝ "
Diameter of center of axle	4⅝ "

Length of tender frame over bumpers	22 ft.
Length of tank	20 ft.
Width of tank	9 ft. 4 in.
Height of tank, not including collar	4 ft. 2 in.
Height of tank over collar	4 ft 11 in.
Type of back drawhead	Gould coupler

Names of Manufacturers of Special Equipment.

Wheel centers	American Steel Casting Co.
Tires	Latrobe
Axles	Baldwin Locomotive Works
Sight-feed lubricators	Nathan Mfg. Co.
Bell ringer	Snow Air Bell Ringer
Front and back couplers	Gould
Safety valve	Consolidated
Muffler	Consolidated
Steam heat equipment	Consolidated
Reducing valves	Foster
Sanding devices	Leach
Injector	Metropolitan & Monitor
Driver brake equipment	American Brake Co.
Tender brake equipment	Westinghouse
Tender brake beam	National Hollow
Tender brake shoe	Baldwin Locomotive Works
Driver brake shoe	Ross cast steel
Air pump	9½ in. Westinghouse
Air-pump governor	Westinghouse
Steam gages	Ashcroft
Engine truck springs	Baldwin Locomotive Works
Driving springs	" " "
Tender springs	" " "
Piston-rod packing	U. S. Metallic Packing Co.
Valve-rod packing	" " " "

Other specialties: "Gold" hose couplers, magnesia sectional lagging (Keasley & Matteson) and Foster inside injector checks.

Present Status of the Distribution and Transmission of Electrical Energy.*

BY LOUIS DUNCAN.

The industrial life of mankind is made up of two things: The transformation and distribution of material and the transformation and distribution of energy. The raw material from mines and forests is changed to finished products and distributed among the people, while energy, obtained from water power, coal or other sources, is changed from the potential energy of the water or the energy of chemical combination to mechanical power, heat, light, etc. Unless we can transmit this energy economically, we must transform it into the required form at the place where it is to be utilized. At present a large part of our mechanical power is obtained from steam plants situated in the factories themselves, and for heat and light we mainly depend upon stoves and lamps in our houses.

Before the introduction of electrical transmission, it was possible to distribute energy to limited distances by various methods, but no system offered a long distance transmission for all purposes. By means of compressed air or steam pipes the energy of coal has been transmitted to produce mechanical power or for heating, and gas mains have allowed the distribution of gas for lighting or for fuel.

In the case of power obtained from steam plants the economy incidental to large units and a steady load has led to the concentration of industries. Where steam is used the plants are situated where it is most convenient for manufacture. Where water power is employed it is necessary to bring the factories to the location of the power irrespective of other conditions.

By means of dynamo electric machines, the energy obtained from either coal or water power may be transformed into electrical energy; may be distributed and then transformed again into mechanical power, light or heat, or may be used for a number of purposes peculiar to this form of energy alone. The limits to the distance of this distribution are imposed by conditions of economy and safety.

It is my purpose to take up the different methods of transmission and distribution and to consider the limits that are actually fixed by the present status of electrical development. The question is a commercial one, each problem presenting different conditions which must be considered, but certain general principles govern each case, and our knowledge and experience makes it possible to judge the practicability of each particular transmission.

Generating Plants.

At the present time practically all of the electrical energy distributed is generated in plants operated either by steam or water power, and it is important to consider the conditions of maximum economy in large generating plants, as this bears directly on the subject of transmission and distribution.

A large proportion of the electrical plants in this country are steam plants. In the last 10 years we have advanced from small stations using high speed dynamos for light and power distribution to large stations, using, as a rule, low-speed direct-connected machines. The simple engines that were used some years ago have, in many cases, been changed to compound and even triple expansion engines, and where it is possible condensers have been employed. Some of the latest plants have machinery of the highest possible efficiency, and yet if we consider the price per horse-power of the power generated, we will find that it is greater than we expect. This is partly due to the fact that for both lighting and power purposes the load on the station, is, as a rule, not uniform and the apparatus is not working under the best conditions for economy. In this country electrical energy is principally generated for electric lighting, for electric traction and for supplying stationary motors, the stationary motors, as a rule, being supplied with current from lighting stations. If we take the load diagram of such stations in large towns, we will find that the average output is not greater than 30 to 40 per cent. of the maximum output. We have, therefore, to supply a large amount of machinery corresponding to the maximum demand on the station, while for distribution a large amount of copper is required that is only being used at its maximum capacity for a comparatively short period of the time. In stations supplying power for traction purposes we find a variation of load, but the variation is a different kind from that found in a lighting station. In the latter the load varies at different hours in the day, but for any particular instant it is practically constant. In the former the average load for different hours during which the station is operated will be practically constant, but there will be momentary variations depending upon the size of the station and the type of traffic. Taking, for instance, a 2,000-H.P. station in Baltimore, I find that the average load is 48 per cent. of the momentary maximum load. This difference in the kind of variation for the two types of stations necessitates employment of different apparatus to obtain the maximum economy for each type. For lighting stations triple expansion engines may be used, while for traction work, where the variation in the load is sudden and may occur after the steam is cut off from the high pressure cylinder, it is not well in general to go beyond compound engines, and there is even a question as to whether simple engines are not more economical when condensing water cannot be obtained. In any case, however, it is of the utmost importance as regards economy of operation that the load should be made as constant as possible.

Two distinct types of distribution are used for incandescent lighting in this country—the single-phase alternating current and the direct three-wire system. At the present time the former does not permit the supplying of power. As alternating distribution is at high potential it does permit the location of the station where the conditions of maximum economy can be fulfilled. The three-wire incandescent system using low voltages may be used for supplying motors, but the amount of copper necessitated by the low pressure has caused such stations to be located near the center of distribution irrespective of the best conditions for the economical operation of the plant.

With the alternating system, it seems impossible to provide even a moderately steady output but with the continuous current system the motor load during the day gives an average output greater in proportion to the maximum. Some years ago the question of the relative values of the alternating and direct-current systems was discussed, and for a while most of the stations installed were of the alternating type. At present the tendency seems rather in the direction of continuous-current stations, especially in towns where there is a large demand for current within a comparatively small area. There is a great advantage of direct currents in that they allow the employment of storage batteries, which equalizes the load on the station. In almost all of the large lighting plants, both here and abroad, this plan has been adopted to a greater or less extent and the results have been so favorable that the battery equipments in many of our stations are being increased. The efficiency of batteries in lighting stations is comparatively high, while the depreciation has been greatly reduced, and is not now over five or six per cent. per annum. In most systems, however, the full benefit of the storage batteries is not realized, as the batteries are placed in the station, and while the advantage of an approximately constant load is obtained, yet the further advantage offered in distribution is not secured. I will take this question up later.

In New York, Brooklyn, Boston and Chicago a large proportion of the direct-current ligting stations are situated where it is expensive to handle the coal and ashes, and where the economy, due to condensation, is not obtained. It is also the custom to use several stations instead of a single large station, and this increases the cost of production both in operating expenses and fixed charges. The question arises whether we have reached a point where it will be more economical to consolidate the stations in the best possible location for economical production of energy, and make use of the means of distribution which have been developed in the last few years to increase the radius at which energy can be supplied.

As far as traction stations are concerned, their efficiency and output would be increased by the use of batteries, both because the machinery would be steadily loaded be used as is the case in lighting stations. By the conand because the most efficient type of apparatus could solidation of railroad properties that has taken place in the last few years single corporations operate electric lines over extended areas. It is the custom to build a number of stations, each running a certain section of the line, the idea being that the decreased cost of copper and the decreased possibility of a shut-down would more than compensate for the increased cost of operation and fixed charges. It is, again, important to consider the question whether we have not reached the point where a single station can be built in such a way that there is little or no possibility of any accident causing a suspension of the entire traffic of the system, and where improved methods of distribution will decrease the amount of copper so that it will not exceed that required by the present method of using a number of generating stations.

If storage batteries are used, the two types of variable load belonging to lighting and power stations demand different types of battery. For lighting stations a considerable capacity is required, while the momentary variations of power stations do not require any great capacity, but demand as great a maximum output as battery manufacturers can obtain.

In water-power plants, the conditions of economy are different. The location of the plant is, of course, definitely fixed, and the advisability of obtaining a uniform load, by means of batteries, depends upon the local conditions. If the water power is limited and is less than the demand, then it might be well to use batteries in order to increase the amount of salable power: Again, if the development is expensive, it might be cheaper to develop a smaller amount of power, pay for a smaller amount of machinery and increase the output by the addition of batteries. These are questions that can only be decided by a knowledge of the local conditions.

We may conclude that while the practice in large lighting and traction systems is to multiply stations near centers of consumption, yet the economy of a single large station makes it important to consider whether it is not possible to concentrate our power at some point where the expenses will be a minimum and distribute by some of the methods which have in the last few years proved successful and economical. It is important to make the station load steady, and this may be done for continuous current lighting and traction plants by means of storage batteries.

Electrical Distribution.

I shall first consider the condition of affairs in a traction system in a large city, where a number of suburban lines are operated. If direct distribution is attempted from a single station, it will be found that when the distance exceeds five or six miles a large amount of copper must be employed to prevent both excessive loss and excessive variation of potential on the lines. On suburban lines it is the latter consideration that usually determines the amount of copper used, and this is especially true on lines where there is a considerable excursion traffic. Even in the city itself, the supplying of sections at distances three or four miles from the station may require so much copper that it would be less expensive to operate separate stations. Several methods other than the direct method may be employed to remedy these difficulties. For outlying lines where the traffic is mainly of the excursion order, being variable both during the day and for different seasons, boosters may be advantageously used. It is perhaps best from reasons of economy to run the boosting dynamos from motors. These dynamos are series wound and are connected to feeders of such resistance that the fall of potential in the wire for a given current is compensated for by the rise in voltage of the booster. There is a decreased cost of copper incidental to this system, due to the fact that the drop is not limited by considerations of regulation—the voltage at the end of the feeder being constant—while the transmission is at an increased potential. If the average station potential is 600 volts, and it is boosted 300 volts, then the copper for a given loss would be decreased in the ratio of 36 to 81. The booster system has the advantage of the direct system when the cost of the additional apparatus together with the increased loss on the line, capitalized, is less than the increased cost of the copper necessary to produce the same result by the direct system. Whether the balance is in favor of one or the other depends on the distance and the variation

*President's address at the New York meeting of the American Institute of Electrical Engineers, Sept. 23, 1896.

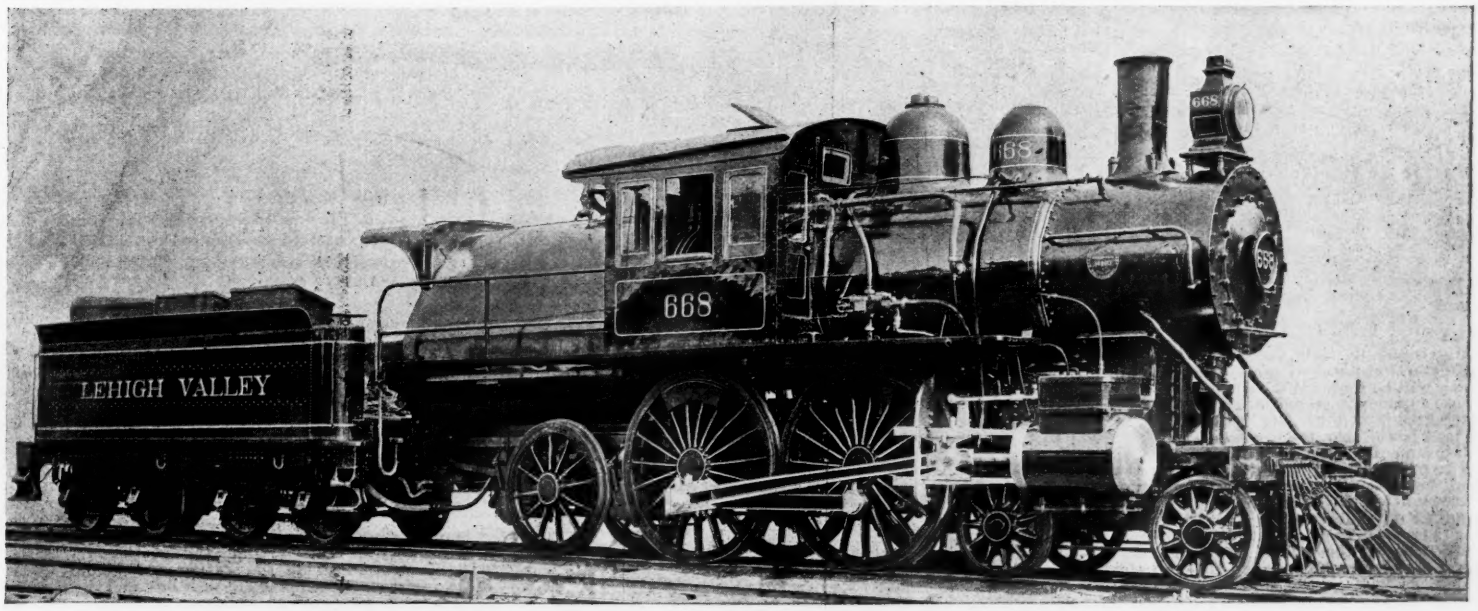


Fig. 1.—Wide Firebox Passenger Engine—Lehigh Valley Railroad.

Mr. S. Higgins, Superintendent Motive Power. *Built by the Baldwin Locomotive Works, Philadelphia.*

of the load, and it is indifferent whether the variation in the latter occurs often or not.

If any transforming device is employed to feed a distant section of the line, it must be remembered that the capacity of the device must be great enough to look out for the maximum demand on this section. Suppose, now, that we wish to feed some suburban line where the load has considerable momentary fluctuations, but where the traffic is moderately constant during the year. In this case the booster could be used with a storage battery at the end of its feeder, the battery supplying the line. The advantages of this combination are greater than with the simple booster, and in many cases they will compensate for the interest and depreciation on the battery and the loss in it. If the arrangement is properly made, the load on the booster and line wire will be practically constant, thus decreasing the capacity of the booster to that required for the average load, while less copper will be required for a given loss. As to the latter point, suppose a given amount of power is to be distributed in 24 hours, say 200 amperes at 600 volts, if the load is uniform, the loss will be proportional to $200^2 \times 24$ hours. If it is all distributed in 12 hours, the loss will be proportional to $400^2 \times 12$ hours, or twice as much. So in the case of the steady load the same power could be transmitted with the same loss with half the copper. It makes no difference whether the variation extends over 12 hours in 24 or it occurs every other minute, the result will be the same. It is apparent, then, that it is of the utmost importance to keep the line steadily loaded, as well as the station, and this points to the location of the battery near the points of consumption and not in the station. By this system—a booster with storage batteries—it is possible, assuming the same loss, to transmit power to a distance of ten miles with approximately the same amount of copper that would be required for a five-mile transmission on the direct system. It would increase the economical radius of distribution twice and the area of distribution four times. A single station could economically supply lines within distances up to ten or twelve miles. If it is desired to still further increase the radius of distribution, it is possible to do this by employing some of the alternating current methods that have come into use. I will discuss these methods later, but at this point I may remark that the use of stationary and rotary transformers permits the energy to be transmitted in the form of alternating currents, and to be changed again into continuous currents of any required voltage. These rotary transformers supplied by an alternating current which is transmitted from the station at a high voltage, may be used to feed the line directly or they may be used to supply storage batteries which are connected to the line. In the latter case we have the advantage of decreased size of apparatus, of steady load on the station, and of a minimum cost of copper on the line; which system it would be best to employ would depend upon the distances and the character of the line and load.

Of the systems that I have proposed for city and suburban distribution from a single station, three have been successfully employed, namely: the booster system; the booster system with batteries and rotary transformers operating directly on the line. When we consider the advantages of a single station and a steady load, it seems evident to me that many of the large traction systems would do well to concentrate their stations into one and to use the booster system with batteries for their outlying lines, and if necessary use rotary transformers for lines beyond the limit of ordinary suburban work. As to the possibility of the complete shut-down of such a station, we have reached such a point in the construction of machinery, both electric and mechanical, that with a proper reserve, a careful system of duplex steam piping, and with fire-proof construction of the station, such a possibility may be disregarded; while the batteries would look out for any momentary interruption on the feeders.

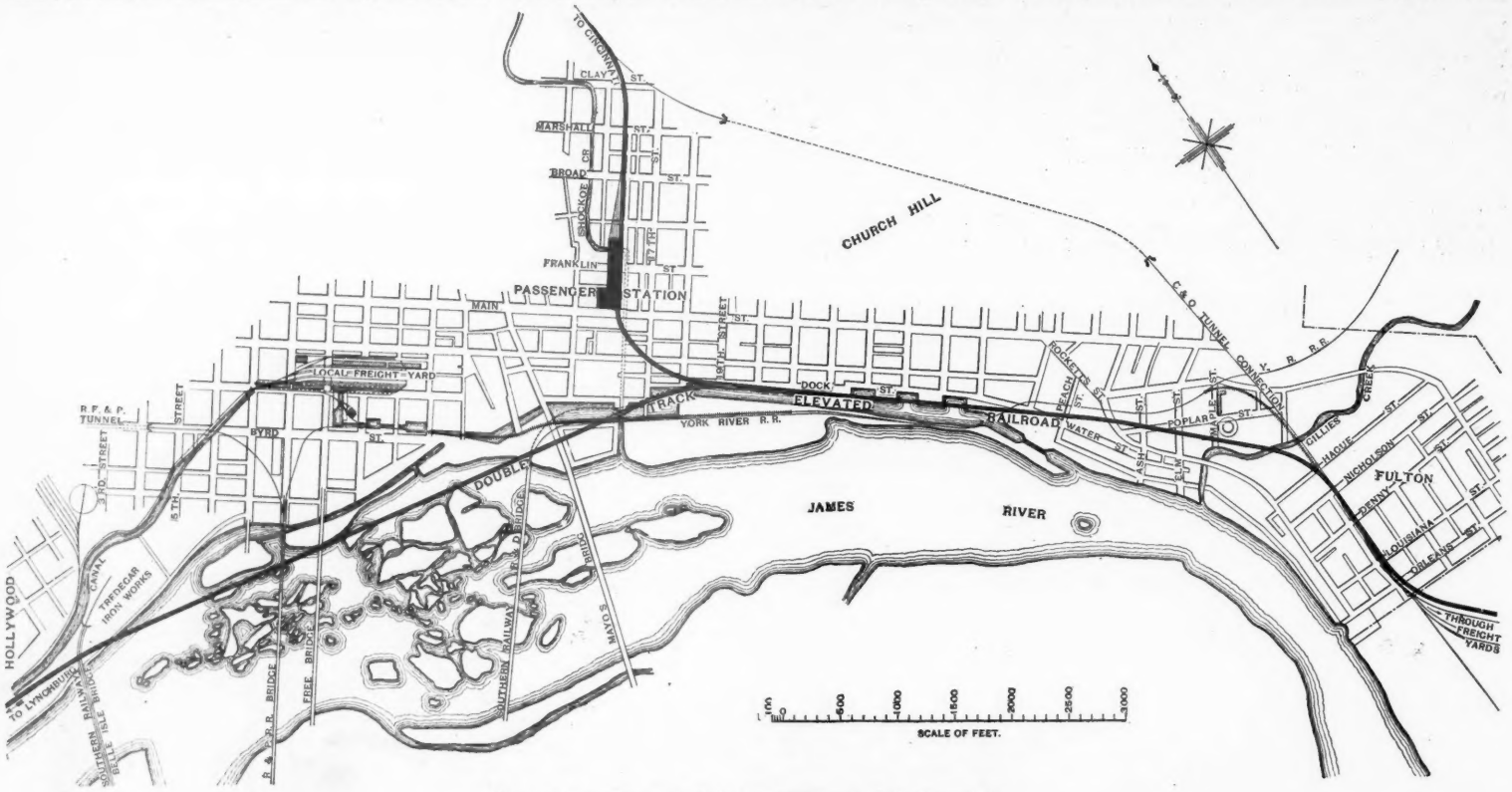
Continuous Current Low Voltage Distribution.

Some of the most important stations supplying incandescent lamps are operated on the three-wire continuous current system. In the last few years a considerable advance has been made in the sale of power for motors from these stations, and this has increased the revenue and has given better average output. The tendency in this country has been in the direction of using storage batteries in such stations, and abroad practically every continuous current station uses batteries. As in the case of traction systems it has been the custom in large cities to build a number of separate stations instead of building a single plant and distributing from it. The batteries have been placed in the stations themselves and no attempt has been made to decrease the amount of copper used by employing a number of centers of distribution and giving the main feeders a steady load. The same consideration that apply to stations for traction work will also apply to stations used to supply lights and the same methods of distribution may be used. It would unquestionably be more economical, in many instances, to use single stations, to transmit power from these stations to centers of distribution, where batteries may be located and to distribute from these centers on a three-wire system. A case in point is the system used at Buda Pesth, where the energy is distributed from the central station to rotary transformers at sub-stations, these rotary transformers feeding batteries, current being distributed from these batteries on a three-wire system. The reports of the operation of this station show that it is both economical and successful, and it might well be copied by some of the companies in this country. The gross receipts of some of the large illuminating companies bear such a large proportion to the company's stock that a comparatively small saving in operation would mean a considerable increase in the dividends, and there is no doubt in my mind that by using one power station, with battery sub-stations for distribution, that the operating expenses can be considerably decreased.

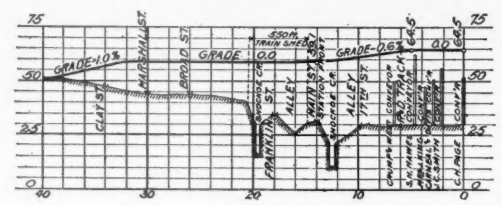
Alternating Currents for Lighting.

Alternating currents have been employed for lighting in this country, and they have been especially valuable where a district is to be supplied in which the distances are considerable as compared with a number of customers. It has been almost the universal custom to supply small transformers for each consumer, and while the average size of transformers is greater now than it was a few years ago, yet they are comparatively small. No power has been supplied from such stations, and although alternating arc lamps are used to a limited extent, yet the number is not increasing, and in some cases continuous-current arc lamps have been substituted for the alternating. Under these conditions the load on the station is even more variable than in the case of a continuous-current supply where motors may be employed, and the constant loss due to the large number of small transformers used places this system at a disadvantage as compared with the continuous-current system. The great advantage it possesses lies in the increased area of distribution rendered possible by the high voltages that are used, together with the possibility of locating the stations where power can be cheaply made. Abroad in the last few years most of the new stations that have been built use continuous currents, although some years ago the greater proportion of them were alternating-current stations. It is also the custom abroad to use sub-stations with large transformers for distribution, thus doing away with a considerable part of the constant loss due to the small transformers used here. It is not possible, at the present time, without greatly complicating the system, to obtain a steady load on the station, and the only question that arises is the value of sub-stations, and the possibility of using some form of alternating current other than the single-phase.

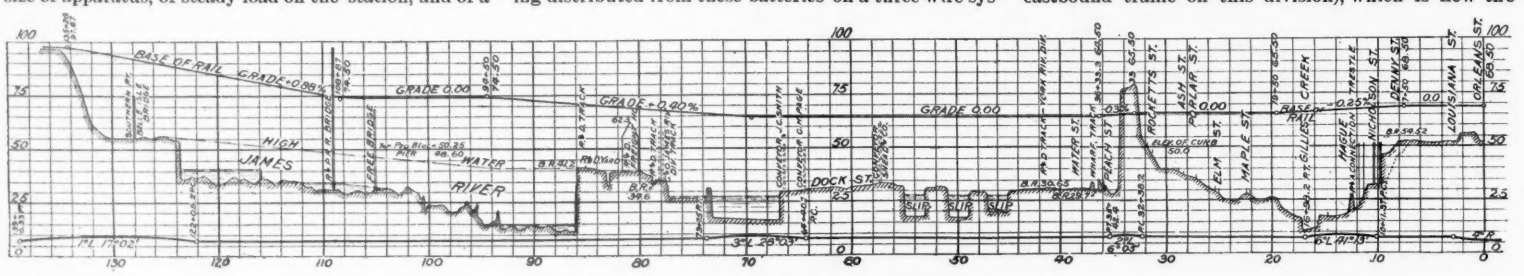
[TO BE CONCLUDED.]



Map of Chesapeake & Ohio Improvements, at Richmond, Va.



Profile, Passenger Station Connection—Richmond Improvements.



Profile, Main Line—Chesapeake & Ohio Improvements.

The Proposed Chesapeake & Ohio Improvements at Richmond.

When the Chesapeake & Ohio reorganization was effected in 1889 and large amounts of money were expended in the rehabilitation of the rolling stock and roadbed, together with the great improvements that were made at Newport News, an expression of astonishment at such large investments came from all who had not made a careful study of the available resources of the road. But after acquiring the Richmond & Alleghany, running from Clifton Forge to Richmond, along the James River, and thus crossing the Blue Ridge on a down grade, as it were (for there are no adverse grades to the eastbound traffic on this division), which is now the James River Division of the Chesapeake & Ohio, the business of the road has steadily increase until, as our readers are aware, the wharves and terminal facilities at Newport News are among the finest and most complete in this country and eight great freight steamers now make regular trips between this tidewater terminal and English ports. There is also a very heavy coastwise traffic to and from Newport News.

The natural growth of traffic that has resulted from the facilities offered has been such that at Richmond the facilities of the road have been overtaxed and the company has found that this has really become an obstructing

point, liable to cause a congestion of cars on both sides of the city. To understand this it must be remembered that the original line of the road entered Richmond from Newport News on the east, passed through a tunnel some 4,000 ft. long, and left the city on the north for Cincinnati, by way of Charlottesville and Clifton Forge, and that between these two last points are the heaviest grades on the road, and that eastbound trains are compelled to climb

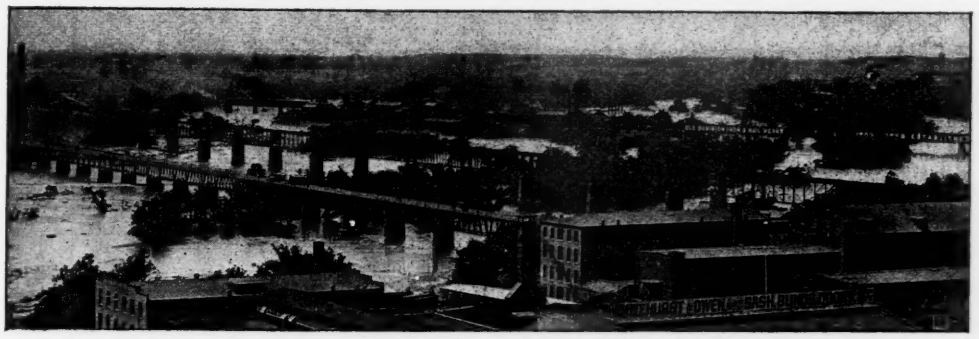


Fig. A.—Chesapeake & Ohio Improvements, Richmond, Va.

North Mountain immediately after leaving Clifton Forge over a grade of 80 ft. to the mile. Naturally, then, all eastbound traffic is sent over the James River Division, where the grades are uniformly favorable. The James River Division, unfortunately, did not connect with the main line of the Chesapeake & Ohio to Newport News. Therefore, in order to transfer through cars, a traffic arrangement was made with the Richmond, York River & Chesapeake (now a portion of the Southern Railway system), by which the use of tracks through the city of Richmond was secured and the connection between the two links of the Chesapeake & Ohio completed.

The Chesapeake & Ohio portion of this connection is a single-track line running through the city, crossing some of the busiest streets at grade, while at other points it is carried on a high timber trestle with adverse grades, that to the eastbound being 58 ft. to the mile, while to the westbound it is 105 ft., thus necessitating the breaking up of the trains and the hauling of them through the city by switching engines, involving innumerable delays and interrupting street traffic. It has become absolutely necessary, therefore, to remove this obstacle.

Realizing that half-way measures are always unsatisfactory, elaborate plans were formulated and the passage of an ordinance by the Common Council of the city of Richmond secured for the construction of a line which will completely do away with the present troubles. Briefly, this plan consists of the erection of an elevated structure through the city, connecting the James River Division with the main line to Newport News beyond the city limits and, incidentally, of a new passenger station for the accommodation of the trains of all three divisions of the road. The obstacles, physical, political and financial, to the final execution of this work have been innumerable; and to show what some of them have been we give a full description of the whole scheme, illustrated by drawings supplied by Mr. H. Frazier, the Chief Engineer of the road, and photographs of the river site that it is proposed to occupy.

In the accompanying map, the whole line of the improvement is clearly laid down. On the present line through the city, a train from the west runs into the yard shown at Second street where the cars are delivered to the Yard Master, the whole distance from this point to the connection with the main line at the other end of

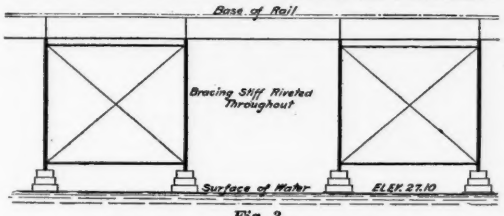


Fig. 3.

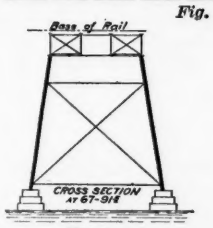


Fig. 4.

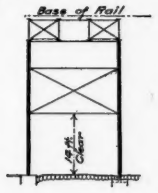


Fig. 5.

Chesapeake & Ohio Improvements.

the city being operated as a yard. Leaving this yard, the present single track follows the fine line on the map as drawn through the city, and it is only on those sections where this line is crosslined that the track is elevated. It will be seen that grade crossings are numerous. The use of the new double-track viaduct will save several hours for practically all of the freight.

The engineer has turned his new line from the old at Hollywood and boldly taken to the water. It is a common thing to bridge a stream, even one filled with rapids; but it is very unusual if not unique to turn a railroad into a river filled with rapids and run down stream for a mile, finally landing upon the same side from which the the start was made; and yet this is exactly what it is proposed to do in this instance. The present conditions of this portion of the line are shown in the half-tone cuts. Fig. *A* is taken from the roof of a building in the city, immediately above the present trestle connection. Crossing the river are three bridges: the one at the left is a city highway bridge, which will hereafter be referred to as the "free" bridge, a portion of the deck of which will have to be lowered in order to allow the new viaduct to pass above it. The next, or middle one of the three, is that of the Atlantic Coast Line, whose rail level will not be disturbed by the improvements; although plate girders will be substituted for the pin trusses now in use, in order to provide head-room for the trains on the proposed viaduct which will pass beneath it. The third bridge, the one in the background on the extreme right, is the Belle Isle bridge of the Southern Railway,

Chesapeake & Ohio Improvements.

and will be left undisturbed, the new viaduct passing overhead.

The other illustration is from a photograph taken from the north end of the lower bridge of the Southern Railway (below the three shown in Fig. *A*), at the point where the viaduct reaches the shore, and shows the rapids on a line looking up stream along the center line of the new structure.

On this section of the viaduct the grade is favorable to the eastbound traffic, having a fall of 0.88 per cent. for about 2,500 ft., followed by a level, to be again followed by a drop of 0.40 per cent. for a short distance, as shown by the profile.

After reaching the shore again, the road will be carried on an elevated structure nearly to the city limits, except at one point between Rockett's and Peach street, where it runs on the surface for about 200 ft. Just at the city limits there will be an earth embankment for a short distance, and beyond will be the new sorting and dispatching yard, the line first making a connection with the tunnel line as shown.

Returning now to Nineteenth street, we find a line leading off to the new passenger station. This structure will be built with a front on Main street, and it will probably cost about $350,000. The approach to this station is, of course, elevated, and a short extra line will be built from the back or north end of its train shed to connect with the tracks that now run into the Broad street station of the main line.

In using this viaduct the freight trains entering from the west will pass through the city, and the road crews will run through to the yard at the further end. Passenger trains from Newport News to Cincinnati and the west or north will run over the viaduct from the yard at the eastern end and into the station, passing out at the north end of the shed, while trains from Cincinnati will naturally follow the opposite course. Passenger trains entering from the west by way of the James River Division will run down to Nineteenth street and then back into the station; while outgoing trains over the same division will back out to Nineteenth street and then run over the viaduct to the west. In this way all passage through the present tunnel for passenger trains will be avoided, while by maintaining it for freight traffic, no trains of that character will ever be run through the passenger station.

The general structure of the ironwork will consist of columns resting upon suitable foundations, with the cross-girders framed between, and the longitudinal girders resting upon the top of those running across. Plate girders will be used throughout except on the river spans, and there will always be at least 13 ft. of clear headroom above the streets, while on the structure itself there will always be at least 20 ft.

As we enter the viaduct from the west, we find that it turns with a gentle curve to the right, and runs out over the river. In consequence of the fact that it runs with the stream instead of across it, the piers are made double and fronting up stream, parallel with the line of rails. It is not anticipated that any very serious engineering difficulties will be encountered in the construction of these piers. The water in the James River is at times very low, and advantage has been taken of these seasons to locate each pier and such soundings have been made as were required to determine exactly what will be demanded at each point. The river bottom is of solid rock of granite formation, and will only need to be stepped off or leveled in order to afford the proper footing for the masonry. The mason work will be carried above the highest-known water mark, and on it a bridge of thirty spans will be erected. One of these will be a plate girder 52 ft. long, and the others will be pin trusses 124 ft. center to center of end pins, the design of the whole being clearly shown in our engraving Fig 1.

As is so frequently the case, the main difficulties to be overcome lie not so much in the natural obstacles as in existing structures that must be changed without impairing their usefulness. Thus one of the first obstacles met after entering the river is the Atlantic Coast Line bridge, where rail level is at such a height that the new viaduct will pass beneath it, but the bottom of whose trusses are too low to allow the necessary headroom without some change. The present bridge has trussed spans, and at the point beneath which the viaduct is to pass the distance between pier centers is 140 ft. 7¼ in. In order to allow for the passage of the viaduct trains and

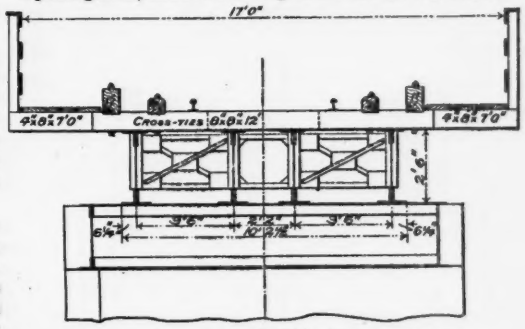


Fig. 2.—Chesapeake & Ohio Improvements.

give a clear headroom of 20 ft. above the rails, it is necessary that the depth of the girders of this existing bridge shall be very much reduced. It has, therefore, been agreed that the present span shall be removed and three-plate girder spans be substituted in its place. This involves the building of two new piers in the river. The construction of the one above the viaduct is shown in Fig. 2.

The next point at which the requirements of the proposed viaduct clashed with existing structures was at the crossing of the "free" bridge. This is a public thoroughfare between Richmond and Manchester on the south side of the James River. The present floor level of this bridge is shown on Fig. 1, and it will be seen to be at such a height as to render the passage of the viaduct an impossibility. It has, therefore, been agreed between the city and the railroad company that the latter shall lower the floor of the free bridge 9 ft. and use a plate girder, as shown in Fig. 1, for its own construction, thus affording a clear headroom of 13 ft. above the level of the highway bridge where it passes beneath the viaduct. The lowering of the floor will start at some distance back from the center line of the viaduct and the grade will not be as steep as that now existing on the present approaches.

Of course in the reconstruction of the two new bridges the work will be done without interfering with the present traffic. On the railroad bridge the new spans will necessarily be put in place without disturbing the rail lines, but, on the free bridge, it is proposed to erect falsework in the stream below the piers and slide the existing

spans down upon it, thus creating an offset in the alignment which will remain until the new spans are opened to traffic. During this period of construction the wagon traffic will not be disturbed in the slightest, but the electric cars that now cross the bridge will be temporarily confined to the use of a single track over the offset portion.

After passing the free bridge the viaduct has a clear run to the shore, and it is this portion of the location that is illustrated in its present aspect by one of the half-tone engravings.

Immediately after reaching the shore the viaduct passes over the tracks of the Southern Railway. On the shore the standard construction referred to at once appears, though on curves to take the side thrust the columns will have a batter of one in six, whereas upon the tangents they will be vertical.

Owing to the fact that these columns must be placed in the street at certain places, and as it is desirable that they shall occupy as little space as possible, they will invariably be located in such places with their sides parallel to the curbs. It will be borne in mind that the details of the structure have not yet been worked out, except in the general design, and this is clearly shown by Figs. 3, 4 and 5. Care has been taken in the designing of the work to use as few different shapes as possible. The columns and their bracing are set in towers with a longitudinal span of 30 ft., with the intermediate spans varying according to the exigencies of the particular location; but these, too, are duplicated to as great an extent as possible.

Naturally, in such a work as this, there are many cases that have to receive special attention. Shortly after reaching the shore there is a case of this kind. Just beyond the crossing of the Southern Railway there are two freight sheds with high brick office structures at their western ends. The buildings are 38.6 ft. apart measured along the curb line of Fourteenth street, which makes a somewhat sharp angle with their center lines. The alignment of the viaduct has been so adjusted that it runs midway between these two office buildings, which will not be disturbed, while the roadway will be carried over the roofs of one of the freight sheds, the only changed involved being the reconstruction of two of the corners of the buildings to take columns for carrying the viaduct and the placing of columns on the floor of the shed to extend up through the roof.

The James River Division of the road is built upon the towpath of the old James River & Kanawha Canal. This canal had a tide-water connection, and, at its locks, a water-power was established for driving the mills of the city, while slips and docks were located along it for the accommodation of warehouses and to facilitate the deep-water shipping. There was a time when this canal was crowded with vessels doing business with Southern ports, but with the closing of the canal and the establishment of the Chesapeake & Ohio terminal at Newport News, this has gradually died away until now there are but isolated instances of the use of the old docks of the canal. The line of the canal is shown upon our general map from a point above the Tredegar Iron Works to its junction with the tidewater level of the river below Peach street.

It is in crossing this old canal, which, by the way, is now the property of the Chesapeake & Ohio, that one of these isolated interests is encountered. The road crosses the canal on a line running from Sixteenth street to Nineteenth street, and between Seventeenth and Eighteenth streets it cuts across a corner of it at Seventeenth and Dock streets. Of course, with a steel viaduct crossing this corner, it will be impossible to moor masted vessels in their old berths, so the portion falling beneath the viaduct will be filled in and the canal enlarged to the line indicated on the map, thus providing a larger and better basin at the crossing and intersections of the streets. Special provision must be made in some cases. An instance is shown in Fig. 6, which is a plan and elevation of the crossing of Ash and Poplar streets. It will be noticed that the columns at the left, being located within the building line and, therefore, beyond the immediate jurisdiction of the City Engineer, are square with the structure, whereas those that fall in the street are parallel with the curb line. In this instance we have a line of four columns down the center of Poplar street, one of which is also in the center line of Ash street and another in the center of Ash street only.

This land portion of the structure runs over the flats lying between the hills upon which Richmond is built and the James River. Soundings have been made all along the line, with the result that it is known that there will be no difficulty in securing suitable foundations for the work. In some places the masonry piers will have to be built upon piles, in others the soil will itself be sufficiently solid.

We have already alluded to the new station. The detail plans for this are now being worked out. Kimball & Thompson, architects, of New York, under the direction of the Chief Engineer, are now at work upon the plans and elevations for the stations proper and office building above it, and the details of the train shed and viaduct are being worked up by Assistant Engineer French. The main dimensions are shown on the map.

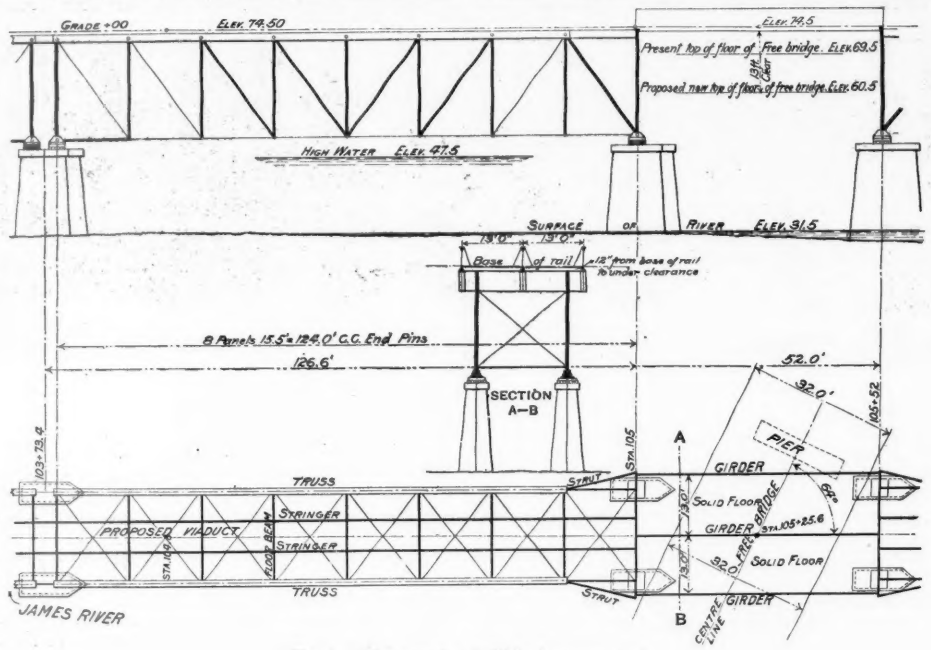


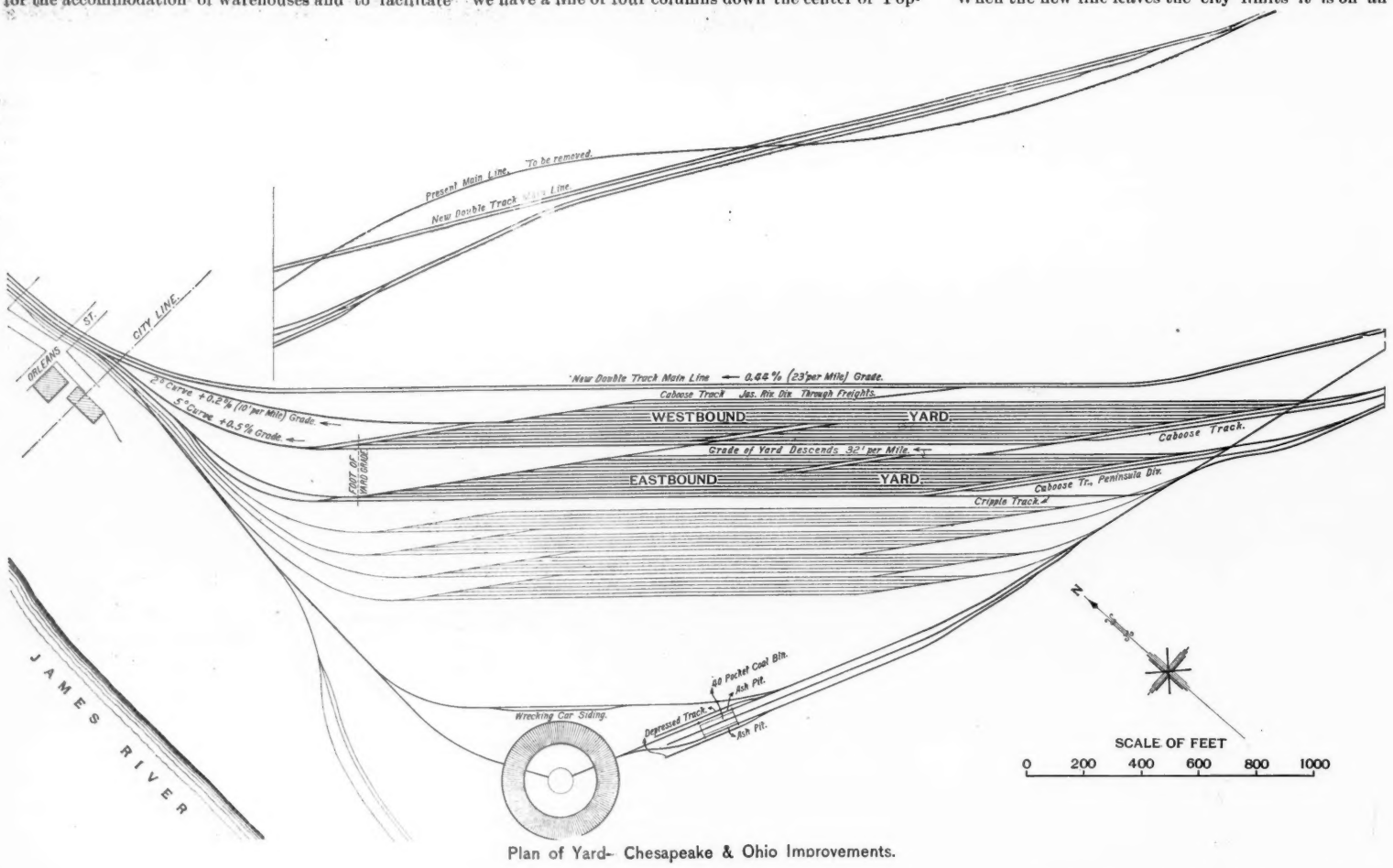
Fig. 1.—Chesapeake & Ohio Improvements.

It is the intention to establish a very complete yard just east of the city limits. At present the ground is open and unoccupied, and the greater portion of that which will be required is already owned by the company.

The track on the viaduct approaches this open space on the slight rising gradient of 0.25 per cent., and touches it at the same point as the present main line. It then curves to the left and crosses the open with a still rising gradient on a tangent until it reaches the present main line, whose position is shown by the dotted line on the plan.

When the new line leaves the city limits it is on an embankment 13 ft high, and is, of course, that much above the level of the open space. At the right hand of the proposed yard a hill juts out to the present main line, which was carried around its base. The alignment of the new line has been so adjusted that the excavations required for it and the yard will furnish all the material needed to fill in the lower portion of the yard. This will amount to about 350,000 cu. yds.

The yard itself will consist of two diamonds; one for eastbound and one for westbound traffic, both having a grade corresponding to that of the main line, or rising



Plan of Yard—Chesapeake & Ohio Improvements.

from west to east and both will be operated by gravity, entrance being made in both cases from the eastern extremity. It is also intended to provide for four additional diamonds, whose location is shown by the fine lines. These will be laid when the requirements of the traffic demand. The two diamonds that will be laid at first are shown by the heavy lines and will each consist of six tracks with a capacity of 60 cars each, and 12 tracks with a capacity of 28 cars each, or a total of 1,392 cars for both diamonds. Each is provided with its own

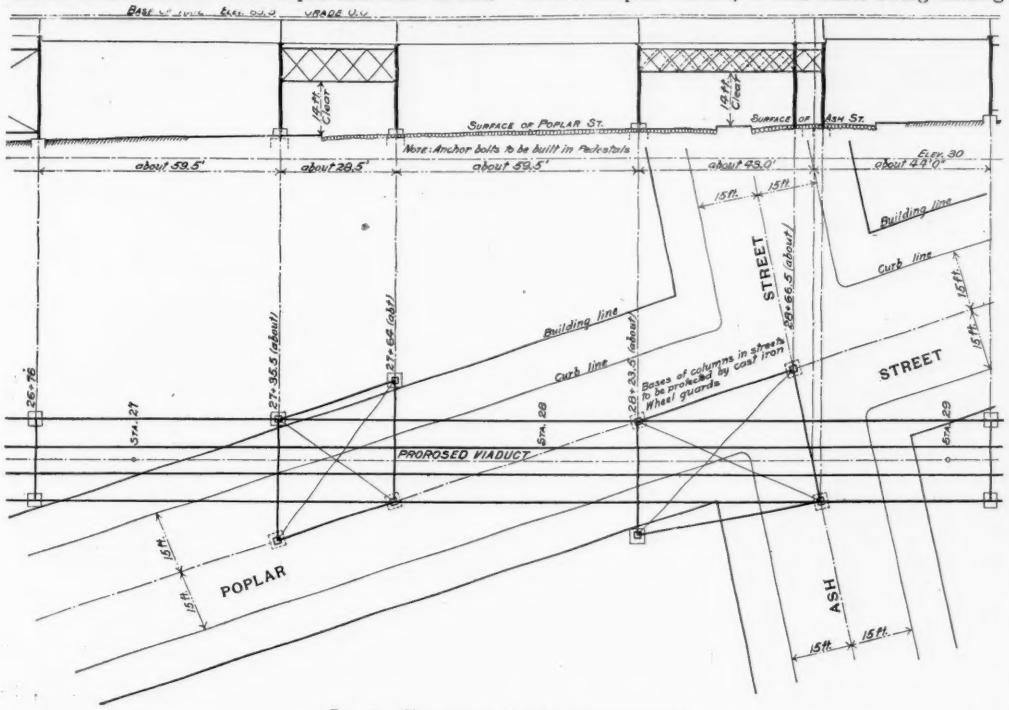


Fig. 6.—Chesapeake & Ohio Improvements.

special caboose track and the westbound yard has also an extra connection for through freight trains that are run from Newport News to the West without being broken, thus receiving an easier curvature and grade than the other line, which is for trains that are made up at this point.

In practical working the yard will be operated as follows: The eastbound trains entering from the viaduct will hold the main line until they have passed the trailing switch of the caboose track and then the caboose will be cut off and allowed to drop down to await its turn for the return trip. The train will then continue on to the junction of the track leading off from the eastbound yard and drop back by gravity, the cars being cut out and distributed to the proper tracks for the new trains that will be run to Newport News, while the locomotive will back down to the roundhouse. With westbound trains the engine will be cut off when it reaches the switch leading to the roundhouse and the cars will be dropped down to the appropriate tracks in the westbound yard, the caboose running in on the track reserved for such cars.

One of the features that will be appreciated by all who have had to do with yard work is the length of the incoming and outgoing tracks lying between the main line and the entrance to the diamond. These will accommodate 60 cars and the locomotive between clearance points, so that after a train is made up and starts out of the diamond it need never, under any circumstances, be stopped until it is clear of the diamond approaches, and yet need not be run far enough to obstruct the main line.

The switches and signals at the two entrances to the yard will be controlled from towers, while the yard switches will be single stands, worked by men on the ground. These switches are so arranged that in the whole yard there is but one double slip switch, all of the remainder being simple single switches. Each diamond consists of twelve tracks, and the outside one is to be kept clear at all times for light engines.

As it is not the intention to do extensive repairs at this point, the cripple track is comparatively short, but it is so located that cars from either east or west bound trains can be readily dropped into it.

On the south side, clear of the yard, a roundhouse with fifty stalls will be erected, having approaches from both directions, and a coaling station with water tanks conveniently at hand, as shown. A by-pass track, running past the roundhouse, connects the two approaching tracks at points well clear of it and the coaling station, and on this there is a siding for the wrecking train.

In reviewing the plan and details of the work from the point where it leaves the present rails of the James River Division to its final connection with the main line to Newport News, one cannot fail to be impressed with the simplicity of the whole design. With the problem, as it is presented, the solution that has been adopted seems to be the most natural one. The details of the structure, its location, the position of the yard and its arrangement apparently leave nothing to be developed later on. But while it appears to be so natural and simple in its final form, it is undoubtedly true of this, as of all other engineering work, that its simplicity is the result of the hard work and careful planning that has succeded in wiping away the original complications in which the scheme was undoubtedly involved.

New Brooks Locomotives for the Erie.

The Brooks Locomotive Works, Dunkirk, N. Y., have recently completed five new 10-wheel passenger locomotives for the Erie road. In the accompanying illustration is shown No. 771, which is a type of the five. They have six coupled drivers, a four-wheel swing leading truck, and a 4,500-gal. eight-wheel tender. A table of dimensions follows:

General Description and Dimensions.

Type	10-wheel passenger
Name or number	771
Name of builder	Brooks Locomotive Works
Name of operating road	Erie
Gage	4 ft. 8½ in.
Simple or Compound	Simple
Kind of fuel to be used	Bituminous coal
Weight on drivers	108,000 lbs.
" " truck wheels	36,750 "
" total	144,750 "
Wheel base, total, of engine	24 ft. 2 in.
" " driving	13 " 6 "
" " total (engine and tender)	50 " 6 "

Wheels and Journals.

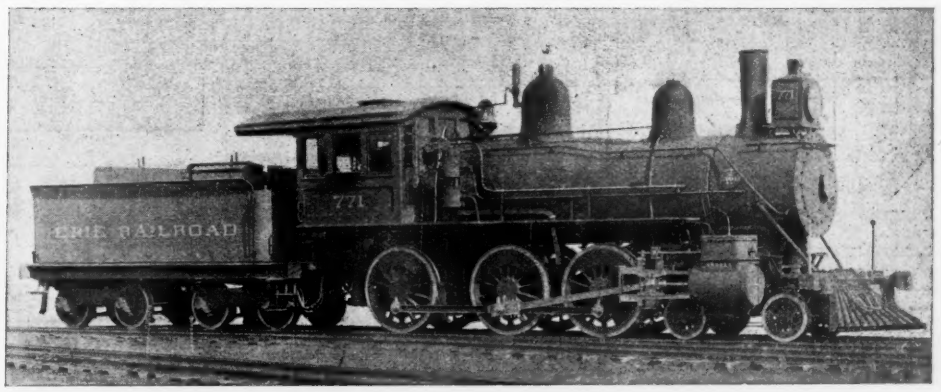
Drivers, number	6
" diameter	62 in
" material of centers	Cast iron
Truck wheels, diameter	30 in.
Journals, driving axle, size	8 in. × 10½ in.
" truck " "	6 in. × 10 in.

Cylinders.

Cylinders, diameter	20 in.
Piston, stroke	26 "
Kind of piston-rod packing	Dunbar
Valves, kind of	American Balanced

Boiler.

Boiler, type of	Radial stayed wagon top.



Ten-Wheel Passenger Locomotive for the Erie Road.

Mr. A. E. Mitchell, Superintendent Motive Power. Built by the Brooks Locomotive Works, Dunkirk, N. Y.

Boiler, working steam pressure	180 lbs.
" material in barrel	Carbon boiler steel plates
" thickness of material in barrel	⅝ in.
" diameter of waist	64 "
Seams, kind of horizontal	Sextuple riveted
" " circumferential	Double "
Thickness of tube sheets	½ in.
" crown sheet	⅝ "
Crown sheet stayed with	Radial stays

Tubes and Firebox.

Tubes, number	282
" material	Charcoal iron
" outside diameter	2 in.
" length over sheets	13 ft. 2 "
Firebox, length	8 ft. 11⅛ "
" width	3 " 4¼ "
" material	Carbon firebox steel
" thickness of sheets	Side and back, ⅜ in.
" water space, width: front 4 in.; sides 3 in.; back 3 in.	
Grate, kind of	Cast-iron finger rocking

Mr. J. T. Brooks on Sound Mone .

At a railroad men's rally in Terre Haute, Ind., Sept. 24, the principal address was by Mr. J. T. Brooks, Second Vice-President of the Pennsylvania Company and of the Pittsburgh, Cincinnati, Chicago & St. Louis, as hereto fore noted in these columns. Mr. Brooks has a gift for plain speaking and his address was a very practical and cogent argument on the present financial question We have not space for the whole, but from the full report in the Terre Haute *Express* we quote a part:

"Advocates of free coinage declare incessantly that the fall in prices of land and commodities has been caused by demonetization of silver. I have never seen a particle of truth given in support of this assertion nor do I know of an article that has fallen in price whose fall cannot be accounted for otherwise than in consequence of demonetization of silver. If demonetization of silver has caused a fall of prices it must be on account of a diminished volume of money, or a higher rate of interest for the use of money; for there is no other natural or logical connection between the two. But we have now in circulation more money than in 1873, both in volume and per capita, and rates of interest are lower now than at that time. . . .

"If demonetization of silver has caused a decline in prices, that decline should affect all commodities within its reach and affect them all alike. It has done neither. In the staple articles prices have been up one year and down another, and if the general tendency has been downward the cause can be directly traced to increased production, diminished cost of production or transportation or diminished consumption. . . .

"If demonetization of silver causes a decline in prices, then prices should maintain their level where there has been no demonetization of silver. England has suffered from a decline in prices, equally with America, yet their standard is gold and has been so for 80 years. Farm lands in England and France are less valuable now than two hundred years ago. The causes that have produced this decline are precisely the same that have brought prices down in America; new wheat fields in the Western states and territories, in South America, India, Egypt and Russia; gang plows, grain drills, self-binders, steam threshers, railroads penetrating from the seaboard of every country to its innermost grain fields, grain rates reduced from 3 cents to ⅓ cent per ton per mile, and on the ocean, steamships that carry, at infinitesimal low rates, the products of every land to the dense markets of Europe.

"Twenty-five years ago American wheat, beef and mutton had an unrivaled market at Liverpool and continental ports. Australia, Argentina, India and Russia are now competitors of the American farmer. Beef and mutton are killed and frozen in Australia and South America, and carried in refrigerator vessels to Europe. When the Suez canal was opened one-third of the mercantile marine of Europe was destroyed. Railroads supplanted river and canal transportation. Electricity is destroying the market for horses and coal. Civilized, ingenious man has progressed farther and faster in the nineteenth century than in the nineteen preceding centuries, and in this imperial procession changes in the condition of the human race are inevitable. The people in the United States are not suffering low prices because of the demonetization of silver, but because of radical changes in the industrial condition of the human race. . . . In this perpetual antagonism between buyer and seller it is clearly impossible to legislate so that one should have an advantage over the other. Each must take his chances as he can and sell as high as he can.

"In June, 1893, the owner of a large furnace who employed a great number of men and indirectly gave work to miners of ore and coal, came to a railroad company and said, 'I have orders for metal enough to keep my business going for months, but the banks cannot discount my paper and give me money with which to pay my men. If you will take my commercial paper for freight money I owe you I can get a little money for my men and they will wait until I can get more.' The railroad officers had to say to him: 'The banks cannot discount that paper for us any more than for you. We have to pay our conductors, engineers, firemen, brakemen and other employees in money. We cannot keep the railroad going.' So the furnace was closed, and furnacemen, coal and ore miners and a part of the railroad forces were suspended from work, all because the banks could no longer give money to business men.

"Bear these facts in mind the next time you hear a demagogue shouting invectives against banks. The Populist and free silver Democrats are filled with savage fury against Wall street bankers and foreign syndicates. They call them opprobrious names, as coupon cutters, gold bugs, money sharks, bank oligarchists and non-producing drones. The Wall street and European capitalists who are thus violently and maliciously assailed are as important and indispensable a factor in our national development as the banks are in local interests. They control the savings of people at home and abroad, and it is concentrated from wider areas and in larger amount than in country banks; this is all the difference. . . . Promoters of works of internal improvement go to Wall street, London, Frankfort or Amsterdam, where money is held in vast amounts; that money is not forced on us. We need not take it if we do not want it, and the question is shall we do without the improvements or shall we condescend to borrow money of a foreigner. The foreigner is neither cruel nor proud; all he wants is to be certain that he will get his money back in as good

money as he lends, and then he is satisfied with a low rate of interest. . . .

"Can any of us afford to throw away our vote in this campaign? I say not. While the Indianapolis convention declared for my political principles, while the candidates are peculiarly attractive to me because they seem to be a simile of 'union' restored again, I know they cannot be elected. I know the Prohibition candidate cannot be elected. It is either McKinley or Bryan. Don't waste your vote. Don't shoot where it won't hit. When we settle the money question I may be, as the Irishman said, 'Ferninst you' on the tariff, but I want to stay with you, and be with you, and die with you on the question of sound money. . . . This time give your vote for McKinley. For, unless McKinley is elected, Bryan will be—and then, woe for the honor of our country."

COMPARATIVE TESTS OF RAILS AND JOINTS—24 IN. CENTER TO CENTER OF 2-IN. BEARINGS.

Load, lbs.	100-lb. rail entire. No. 1. Deflection.	100-lb. rail entire. No. 1. Deflection when released.	100-lb. rail entire. No. 2. Deflection.	100-lb. rail entire. No. 2. Deflection when released.	Standard splices for 100-lb. rail. Deflection.	Standard splices for 100-lb. rail. Deflection when released	100 per cent. splice for 100-lb. rail. No. 1. Deflection.	No. 1. Distance between lower flanges.	No. 1. Deflection when released.	No. 2. Deflection.	No. 2. Distance between lower flanges.	No. 2. Deflection when released.
20,000	.010	.....	.014	.....	.025	.000	.009	.373	.....	.009	.393	.....
40,000	.014	.....	.022	.....	.055	.026	.024	.....	.....	.024	.415	.....
					Elastic	Limit.						
60,000	.022	.....	.030	.....	.228	.205	.035	.388	.....	.034	.....	.....
80,000	.041	.....	.037	.....	.404	.325	.047	.....	.000	.050	.....	.000
100 000	.....	.....	.....	.....	.....	.....	.058	.....	.092	.061	.....	.000
120,000	.047	.....	.056	.....	.....	.....	.072	.410	.006	.074	.438	.002
140,000	.....	.....	.....	.....	.....	.....	.086	.....	.010	.091	.....	.009
160,000	.071	.000	.....	.....	.....	.....	.104	.431	.016	.122	.475	.029
		Elastic Limit.							Elastic Limit.			
180,000	.....	.....	.112	.038	.....	.....	.130	.....	.032	.174	.....	.070
200 000	.138	.052	.197	.109	.....	.....	.170	.479	.083	.245	.587	.132
220 000	.....	.....	.....	.....	.....	.....	.240	.....	.107	.320	.....	.194
240,000	.310	.204	.378	.269	.....	.....	.316	.581	.181	.363	.688	.234
260,000	.....	.....	.....	.....	.....	.....	.365	.....	.223	.413	.....	.296
280 000	.560	.457	.637	.498	.....	.....	.434	.696	.275	.452	.747	.376
Rel. working value	100				25		107					

A 100-Per Cent. Rail Joint.

BY M. W THOMSON. *Prin. Ass't Eng., P. R. R. Co.*

The splicing problem should be treated as a matter of deflection, rather than breakage. To keep the deflection wave uniform at all points requires that the joint structure shall have approximately the same carrying capacity as the solid rail. A splice materially weaker than the rail lets the load drop and punishment ensues; a splice materially stronger than the rail creates a hump and punishment ensues again; in one case about as serious as the other. In seeking for something that could be conveniently rolled, economically applied, and could, at the same time, be readily equalized in point of stiffness to the solid rail, I last year designed and took out a patent on the joint, drawings of which appear herewith. It is best described as a 100 per cent. splice. The inclosed tests of the bars for 100 lb. rail show how closely the deflections and elastic limits correspond with same for the solid rail.

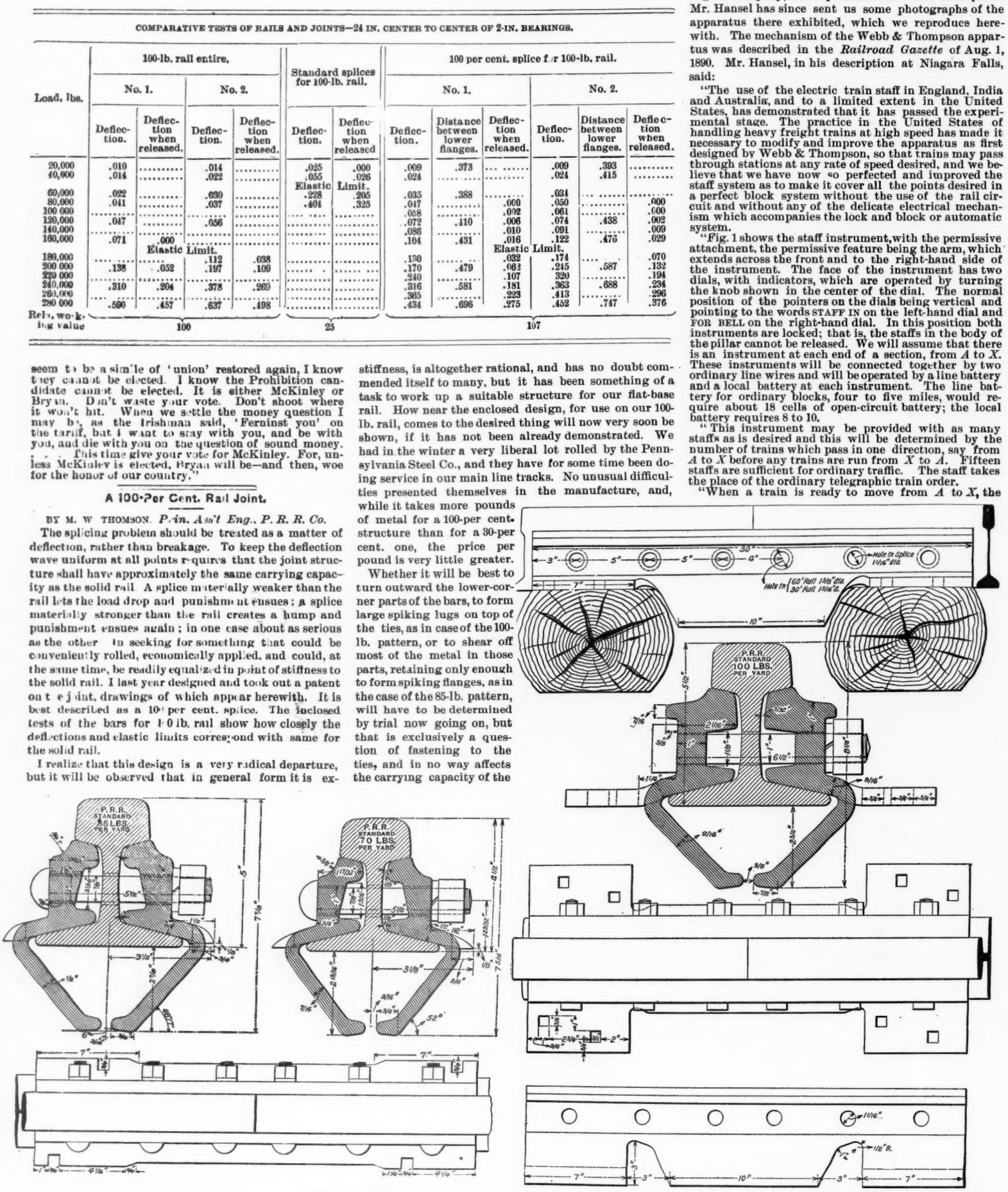
I realize that this design is a very radical departure, but it will be observed that in general form it is exceedingly simple, and the grip on the rail is exactly the same as we have long had in use.

The ordinary angle bars that have been shaped up by rule-of-thumb, and generally used on our roads these many years, range in carrying capacity from 25 to 40 per cent., as compared with the rails to which they are applied. Engineers who have given the subject any considerable thought have, for some time, regarded these angle bars as a make-shift, and your columns have been full of loud complaints. Among the first to realize the advisability of giving the splice bars the same stiffness as the rail was Mr. Banister,* Chief Engineer of the London, Brighton & South Coast Railway. He designed a pair of bars in, I think, the year 1889, for his bull-head rail, adjusting the stiffness, as closely as possible, to that of the rail, and those bars are standard on that road to-day. The principle involved, namely, 100 per cent. stiffness, is altogether rational, and has no doubt commended itself to many, but it has been something of a task to work up a suitable structure for our flat-base rail. How near the enclosed design, for use on our 100-lb. rail, comes to the desired thing will now very soon be shown, if it has not been already demonstrated. We had in the winter a very liberal lot rolled by the Pennsylvania Steel Co., and they have for some time been doing service in our main line tracks. No unusual difficulties presented themselves in the manufacture, and, while it takes more pounds of metal for a 100-per cent. structure than for a 30-per cent. one, the price per pound is very little greater.

Whether it will be best to turn outward the lower-corner parts of the bars, to form large spiking lugs on top of the ties, as in case of the 100-lb. pattern, or to shear off most of the metal in those parts, retaining only enough to form spiking flanges, as in the case of the 85-lb. pattern, will have to be determined by trial now going on, but that is exclusively a question of fastening to the ties, and in no way affects the carrying capacity of the truss, which does not embrace those portions of the bar. The essential, and as we understand it, the indispensable, element, is to have a structure of 100 per cent. strength (no less and not much more) between the two central bolt holes; this being provided, the minor features can be worked out more easily and more at our leisure.

Of course, all engineers know that, when you saw a rail in two, you destroy what is the best form or section for carrying the load, and it will not be possible to devise any splicing structure, lying outside of that section, that will be as perfect or as durable, but it seems desirable to apply something much better than the historic angle bar.

* Mr. Banister retired in October, 1895, after holding position for 35 years, and a pension of $5,000 a year was given him in recognition of his services.



Thomson's 100-per cent. Rail Splice for the Pennsylvania Railroad.

The Webb & Thompson Train-Staff Apparatus.

The description of the electric staff apparatus given at the Niagara Falls Convention of Superintendents by Mr. Hansel, Vice-President of the National Switch & Signal Company, was reported in our issue of Sept. 18. Mr. Hansel has since sent us some photographs of the apparatus there exhibited, which we reproduce herewith. The mechanism of the Webb & Thompson apparatus was described in the *Railroad Gazette* of Aug. 1, 1890. Mr. Hansel, in his description at Niagara Falls, said:

"The use of the electric train staff in England, India and Australia, and to a limited extent in the United States, has demonstrated that it has passed the experimental stage. The practice in the United States of handling heavy freight trains at high speed has made it necessary to modify and improve the apparatus as first designed by Webb & Thompson, so that trains may pass through stations at any rate of speed desired, and we believe that we have now so perfected and improved the staff system as to make it cover all the points desired in a perfect block system without the use of the rail circuit and without any of the delicate electrical mechanism which accompanies the lock and block or automatic system.

"Fig. 1 shows the staff instrument, with the permissive attachment, the permissive feature being the arm, which extends across the front and to the right-hand side of the instrument. The face of the instrument has two dials, with indicators, which are operated by turning the knob shown in the center of the dial. The normal position of the pointers on the dials being vertical and pointing to the words STAFF IN on the left-hand dial and FOR BELL on the right-hand dial. In this position both instruments are locked; that is, the staffs in the body of the pillar cannot be released. We will assume that there is an instrument at each end of a section, from *A* to *X*. These instruments will be connected together by two ordinary line wires and will be operated by a line battery and a local battery at each instrument. The line battery for ordinary blocks, four to five miles, would require about 18 cells of open-circuit battery; the local battery requires 8 to 10.

"This instrument may be provided with as many staffs as is desired and this will be determined by the number of trains which pass in one direction, say from *A* to *X* before any trains are run from *X* to *A*. Fifteen staffs are sufficient for ordinary traffic. The staff takes the place of the ordinary telegraphic train order.

"When a train is ready to move from *A* to *X*, the operator at *A* presses down the lever which is seen at the bottom of the right hand dial, sounding one bell at *X*. *X* acknowledges the call by pressing the lever on his instrument, sounding a bell at *A*. *A* then asks permission from *X* to withdraw staff by pressing down the lever before mentioned three times, giving three rings on the bell at *X*, and immediately turns his right-hand pointer to the left, leaving it in the horizontal position, pointing to the words FOR STAFF, indicating that he desires *X* to release his instrument so that he can take a staff from it. If there is no train between *A* and *X*, the holding down of the lever at *X* closes the circuit in the lock magnets at *A*, which enables *A* to withdraw a staff. As soon as this staff is removed, *A* turns the left-hand pointer to the words STAFF OUT, and as this staff is removed from the instrument at *A* the galvanometer needle, which is seen in the center of the instrument between the two dials, vibrates, indicating to the operator

at *X* that *A* has withdrawn his staff. *X* then releases the lever which he has held down, in order that *A* might withdraw a staff and turns his left-hand indicator to STAFF OUT, and with this position of the instruments a staff cannot be withdrawn from either one.

"The first method of delivering this staff to the engineer was to place it in a staff crane, shown in Fig. 2. The engineer can pick up this staff while his train is running at a speed of 30 miles an hour. A second staff cannot be taken out at *A* nor a staff from *X* until this staff which was taken by the engineer going from *A* to *X* is placed in the staff instrument at *X*; consequently, the delivering of a staff from *A* to the engineer gives him absolute control of the section between *A* and *X*.

"This staff also controls all main-line switches between *A* and *X*, for the trainman cannot open the switch until he has secured the staff from the engineer and inserted it in the switch stand, and as soon as he throws the switch lever and opens the switch he fastens the train staff in the switch stand and it cannot be removed until the switchman has closed and locked the switch for the main line.

"In order that the operator at *X* may be assured that the entire train has passed his station we may divide the staff in two, and deliver one half to the engineer and the other half to the man on the caboose or rear end of train; it will be necessary for *X* to have the two halves as it is impossible to insert a portion of the staff. But a further improvement provides the same measure of safety without carrying the entire staff from station to station. It will be noticed that there are five rings on the complete staff (Fig. 6). It is necessary that all these five rings be on the staff in a certain position before it can be placed in the instrument, and we have so designed the new model as to enable us to remove two of the rings. These rings are handed, one to the engineer, the other to the trainman on the caboose and are carried to the next station and delivered. The operator at each station has a certain number of these staffs with two rings missing, and before he can insert them in the pillar he will have to receive the two rings from the train, and must place them upon the staff to make it complete before he can insert it in the instrument in order to release another staff. The original staff weighs 2¾ lbs., and each ring weighs 2¼ oz. The rings can be picked up at high speed with greater ease than can the entire staff.

Electric Train Staff with Semaphore Signals.—"In order to run at good speed it is essential that the engineer receive advance notice as to whether he will find a staff at a given station, and since the staff itself is not sufficiently large to be visible at a great distance "staff and lever locking" has been introduced, so that a semaphore can be used. This apparatus consists of a cast-iron box fitted on the top plate of the regular interlocking machine.

"The mechanism contained in the box consists of a mechanical lock which can only be operated by the introduction of a staff as a key. When the staff is used as a key to release the signal lever, it can be taken out as soon as it has performed that office and placed in a position to be received by the engineer; but unless the operator has unlocked the signal lever with this staff he cannot clear his signal. The act of releasing the signal lever opens the line wire between the staff instruments at *A* and *X*, the purpose of this being to compel the operator to return the signal to the normal position immediately after a train has entered the block. With the lever in this position it is automatically locked, the line circuit is again renewed and the lever is locked in the normal position until he again has authority to clear it by receiving a staff release from *X*.

"Fig. 4 shows the connections of a semaphore signal. Between the signal arm and the balance lever is located an electric slot so designed that when the staff crane similar to the ordinary mail crane. The two arms of this staff crane are connected with the electric slot on the signal by insulated wire, the circuit being run through a local battery; and as long as the staff crane is in the position shown in Fig. 3 the circuit is broken, the electric slot de-energized, and the signal cannot be cleared.

"When the operator at *A* has withdrawn a staff from his instrument and removed a ring from the same he places this ring on an auxiliary steel ring and engages it in the two arms of the staff crane by bringing them to the horizontal position and slipping the auxiliary ring between the knife contacts on the end of each arm. The placing of this auxiliary ring in this manner completes the circuit through the local battery, and the magnets of the electric slot, which completes the connection between the signal blade and the signal lever and the operator is able to clear the signal. This position of the signal and train staff, or the ring which now takes the place of the staff, is shown in Fig. 5.

"The auxiliary ring is made to facilitate the receiving and delivering of a train-staff ring from a moving train. A hook is fixed on the locomotive in such a manner as to automatically engage with the ring, so that the only duty magnets are de-energized the connection between the blade grip and the balance lever is broken so that the operator cannot lower the arm. Figs. 3 and 5 show

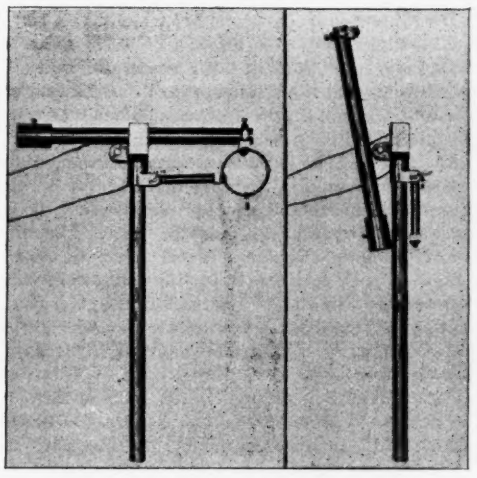


Fig. 5. *Fig.* 3.

Crane for Delivering Rings to Moving Trains.

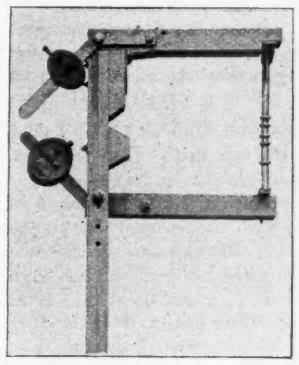


Fig. 2.

Staff Crane.

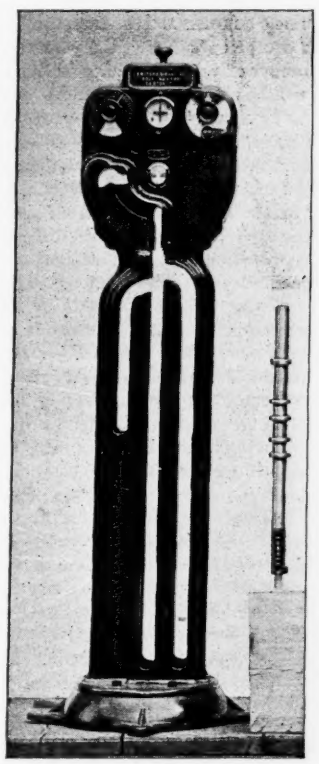


Fig. 6.—Staff Pillar and Staff.

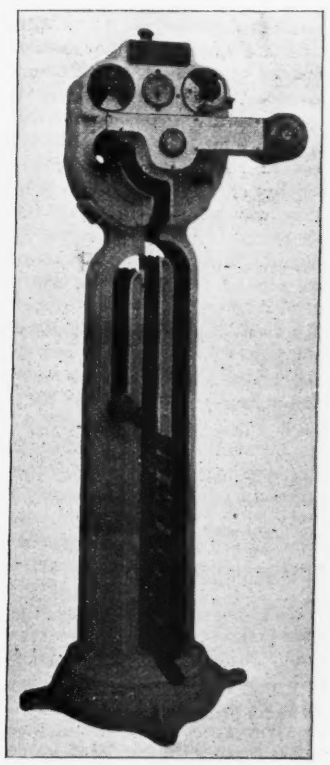


Fig. 1.—Staff Pillar with Permissive Attachment.

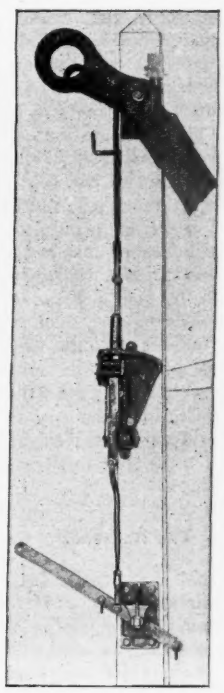


Fig. 4.—Electric Slot.

ELECTRIC TRAIN STAFF APPARATUS.

Made by the National Switch & Signal Co., Easton, Pa.

put upon the engineer is to bring the hook to the horizontal position by depressing the handle of the lever. This apparatus is the same in principle as that used on mail cars, but, of course, much smaller. As soon as the ring is received, the engineman disengages it and places it on the tender in a position to be delivered automatically at the next station ahead. The device to be used on the tender is similar to the staff crane—that is, it holds the ring so that it is delivered on the staff crane in the same manner as before described for receiving the ring.

"If it is desired to use two rings it is only necessary to provide two cranes. As soon as the hook on the locomotive engages the ring and removes it from the crane the circuit is broken through the local battery and the electric slot, the arms of the crane fall to the position in Fig. 4, the semaphore goes to the horizontal position, and the operator cannot clear it until this ring is placed upon the staff at the other end of the section, as before described. The ring is used in connection with the unlocking of switch stands in the block in the same manner as described for the full staff.

Permissive Blocking.—"The electric train staff may be used for a permissive block system, giving the same measure of safety against head-end collisions as described before. With this permissive feature a special staff is used to control the permissive attachment, which is shown in Fig. 1, below the two dials and to the right. When it is desired to use the permissive system the special staff is withdrawn in the same manner as the regular staff before described. The special staff is shown in the left-hand slot of the instrument, Fig. 1. This staff is inserted in the aperture shown on right-hand projection and is used as a key to unlock a certain number of tablets or auxiliary train orders. If it is desired to move a number of trains from *A* to *X* before the first section clears the block, the operator removes a tablet from the box which has been unlocked by the special staff, and this tablet now becomes a train order for the first section. The second section receives a second tablet or train order, and if there are but three sections the third section receives all the tablets remaining in the box, together with the special staff, for it is necessary to have all these tablets and the special staff at *X*, before a second staff can be issued from *A* or *X*.

"By the use of this special staff and the permissive attachment with tablets as described the system may be changed at will from absolute to permissive block. This permissive system has been used for some time by the Chicago, Milwaukee & St. Paul, and Mr Goodnow, Assistant General Superintendent, says in a letter referring to the operation of this system, 'The train staff instruments are giving us entire satisfaction, and we have operated them from the moment they were put in service to the present without the slightest difficulty or hitch. For the past week or ten days traffic across the bridge has been extremely heavy, nearly thirty trains a day being handled. Traffic, owing to the congested condition of the yards both sides of the river, was extremely irregular, and although the working of the staff instruments is such that in order to not delay passenger trains it is necessary to have the permissive staff and tablets at the right end of the block, no difficulty was experienced on that account and no trains were delayed by staff working.' While the movement of 30 instruments a day does not by any means indicate the capacity of these instruments to facilitate traffic, an explanation of the conditions governing the operation of traffic at the point referred to by Mr. Goodnow may be of interest.

"The instruments referred to govern traffic over one section of single track three miles long. This track is intersected by a grade crossing and a drawbridge, necessitating two steps. Owing to the local conditions the speed of trains is limited and ten minutes is the allotment of time for passenger trains and 15 minutes for freight trains over this section, and trains of each class are not permitted to clear the section in less time than that allotted, although they frequently are compelled to take more time by reason of the crossing and drawbridge before mentioned.

"It has been demonstrated that by use of this electric train-staff system the volume of traffic over a single line may be greatly increased over the ordinary telegraphic train order system for the reason that as soon as a train has cleared a section, and the staff has been delivered to the operator and introduced in the train-staff instrument at the end of that section, a second train may be sent without the annoying delays often incident to the telegraphic train-order system." . . .

Some Elevated Railroad History.

The Property Owners' Association of the Twenty-third and Twenty-fourth wards celebrated recently the inauguration of continuous through traffic from 177th street and Third avenue to the City Hall Station, on the Elevated Railroad, over the old "Suburban" elevated. In the course of a short speech Mr. J. J. R. Croes, who was Chief Engineer of the Suburban Rapid Transit Company from 1880 to 1891, said:

"The event which we are celebrating is the forging of an important link in a chain which has been in progress of creation for 20 years. It was in 1876 that the Park Department directed me to prepare the outlines of a scheme for rapid transit in the Annexed District, in conjunction with the plans for streets, which I was then preparing, and which have been the basis of the layout of the district, only recently finally adjusted and confirmed under the judicious and careful management of your Commissioner of Works and his able Chief Engineer.

"The principles which were laid down by Frederic Law Olmsted and myself, in our rapid-transit report of March, 1877, were essentially followed by the Rapid Transit Commission of March 6, 1880, which organized the Suburban Rapid Transit Company on Oct. 11, 1880. The leading spirit in this, as in all improvements in the Twenty-third and Twenty-fourth wards at that period, was Samuel R. Filley, and he assumed the presidency of the company, and conducted its affairs until his untimely death on June 8, 1888. . . . In October, 1883, the building of the bridge across the Harlem River was begun, and on May 17, 1886, we began running trains across it, and on May 21 opened the road to 143d street, and it has been operated continuously ever since, even during the blizzard of March 12, 1888, when the Suburban was the only railroad, surface or elevated, within 50 miles of New York which did not have a train or a car stalled by the snow. This fact we always attributed to the superior character of the structure and rolling stock.

"The experience derived from the conglo neration of crudities in iron construction, which goes by the name of the Manhattan Railway, had set engineers to thinking about what such a railroad ought to be, and the result is shown in the structures of the Suburban Rapid Transit Company, which have, since their construction been copied almost exactly on the elevated roads of St. Louis, Chicago, Pittsburgh and Liverpool, and are still the standard type."

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The first irregularity (of any consequence) in the Joint Traffic Association and the first arbitration are reported this week. The irregularity is the refusal of the Lake Shore & Michigan Southern to make a reduction of 5 cents in the rate on corn to the seaboard during the month of October, as recommended by the Managers. So far as we can see, this not only does no harm, but, on the contrary, serves to show the peculiar value of the elastic features of the agreement under which the Association is conducted. A refusal to raise rates would be another matter, but as long as a strong road does its competitors no worse turn than to keep rates higher than they ask, it will not be very likely to precipitate war. The road itself will be the only party with any motive to complain, and the maintenance of rates in such a case is a distinct announcement that no complaint will be entered. The arbitrators' first decision (passenger fares between New York and Chicago) has the judicial characteristic of extreme conservatism. The fact that the adoption of the Association agreement last January constituted a formal approval of all the then existing rates seems to have been looked upon as conclusive evidence that such approval was deliberate and unconstrained by all the roads; and the arbitrators' opinion, therefore, seems to be that until there shall have been a more marked change in the facilities offered by the competing lines, there should be no change in the rates. A railroad-rate arbitrator's task is always difficult, and it is doubtful if anything in the shape of rules for guidance in such work would be worth the paper it would take to write them on; but if there is one principle that, more than another, has an element of permanent value in deciding rate controversies, it is that no change in rate or in allotment of traffic is justifiable except where there has been a change in distance or facilities which is large enough to be tangible, to be described with mathematical certainty; a change of which there is physical evidence. This principle seems to have been applied in this case. In the matter of Buffalo rates the arbitrators promptly recognized the change of conditions which led to the demand for a reduction of differentials.

The practical failure of the Western Freight Association, reported in these columns last week, has been the subject of much discussion at Chicago. Two or three railroad presidents have expressed the opinion there that no new agreement is needed; all that is necessary is to live up to the old one. In a sense this is true; but precisely the same thing was said in regard to the Eastern situation before the Joint Traffic Association was formed. The association was instituted, nevertheless, and its success has been far greater than was ever attained with any other agreement. It is impossible not to believe that this success is due chiefly to two important features of the J. T. A. agreement that were not present in the old one, and are not in the Chicago agreement now under discussion. These features are (1) that all changes in rates made by individual roads without the concurrence of the Association (Board of Managers) shall be *made only by the directors* of the road, that is, in writing, duly recorded; and (2) that conferences between representatives of the different roads shall be held regularly and frequently (practically every day). These are the two essentials. The first compels every road to tell what it is doing, and the second compels it to tell promptly, instead of waiting until after it has gobbled up a big lot of freight at secret rates. Can it be that the responsible officers of the Western roads do not wish to make use of such powerful instrumentalities for maintaining peace? It cannot be that they have not heard of them. It seems to us that quibbles about "good faith" are the poorest kind of excuses for refusing to abandon the old agreement and to adopt a new one in its place. At first thought it seems as though any road which has deliberately broken one agreement will surely be found slippery in the future; but a good many elements besides pure wickedness enter into secret rate-cutting, and the continued success of the Joint Traffic Association justifies the assertion that the two features which we have emphasized, destroy or greatly weaken most of the motives for rate cutting. Possibly these features even correct vicious minds, though it is sufficient for our present purpose to assume that they prevent the manifestation of viciousness.

An association of Austrian manufacturers has come to the conclusion that the Prussian State railroads carry freight to Hamburg for nothing when it is shipped to Egypt or Turkey, or the "Levant" generally, as the eastern Mediterranean countries are called. They reason in this way: From three German stations near the Austrian border bar iron is billed to Alexandria at 191, 198 and 228 marks for 10 tons, respectively. It goes entirely across Germany by rail to reach Hamburg, and then around three sides of Europe by sea to reach Alexandria—further than from New York to Liverpool. Now the freight from the Austrian Adriatic port of Trieste to Alexandria, about one-third of the distance from Hamburg, is 180 marks, and the port charges are 10 marks for the same quantity, or 190 marks in all, which is nearly as much as the total rail and sea charge by way of Hamburg. The difference of 8 marks can hardly be equal to the higher cost by sea for the 2,200 miles longer voyage from Hamburg. But the rail charges to Trieste from Austrian stations near the German ones named, the distances being less rather than greater than those to Hamburg, are from 200 to 245 marks—more than the German freight all the way to Alexandria. It is actually cheaper by more than 40 per cent. to ship by way of Hamburg from these Austrian border towns. It does not seem to occur to these manufacturers that the difference may not be in the railroad freights alone. In fact the Austrian-Lloyd steamer charge of $4.32 in gold per ton of 2,200 lbs from Trieste to Alexandria—not much further than from Chicago to Buffalo—is not quite what would be expected in these days, and doubtless sailing vessels and tramp steamers would carry for a fraction of that rate. But the incident indicates that the German railroads are not so stiff-necked as some of us suppose, and make rates which the traffic will bear when necessary to secure business.

The Railroads of the United States in 1895.

Last July (page 534) we published some advance statistics, given out by the Interstate Commerce Commission, of the railroads of the United States for the year ending June 30, 1895. An advance copy of the introduction to the statistical volume of the Commission's reports is just received, giving the figures much more completely, and we give below certain of the information to be gathered from that introduction.

Mileage.—The total miles of railroad at the date of the report were 180,657.47, of which 1,482 miles was reported as "unofficial"; that is, we suppose no official reports had been received from the companies owning that mileage. The increase in the total for the year was 1,949 miles. This increase was 1.09 per cent.; the year before it had been 1.27 per cent. It is hardly worth while to point out again that the increase, absolute and relative, has been declining for a number of years.

The mileage reported upon as "operated" amounted to 177,746.25 miles. This, we suppose, is the mileage from which the Statistician of the Commission received full reports of operation. We may say here, however, that still another figure of mileage must have been used in making up the report, for on another page we find the total railroad capital of the United States given as $10,963,584,385, which is averaged as $63,206 per mile of line. Dividing the total capital by the capital per mile we get 173,450 miles of railroad covered by this capitalization.

Per 100 square miles of territory, excluding Alaska, we have 6.08 miles of railroad, and per 10,000 inhabitants we have 26.16. In 1890 there were 5.51 miles of railroad per 100 square miles of territory and 26.05 per 10,000 inhabitants. The state best provided, proportionately to its area, is New Jersey, which has 29.72 miles per 100 square miles, and the next is Massachusetts with 26.35. Nevada has only 0.83 miles per 100 square miles, but as the total railroad mileage of that territory is only 9.6 miles it makes but a trifling figure in the general average, which fact should be considered when one notes that per 10,000 inhabitants that state has 182.65 miles of railroad. Montana, however, has still more, namely, 195.55, while Massachusetts has only 8.61. From the figures collected by the German statisticians, which we published last July, it appears that the United Kingdom has 17.2 miles of railroad per 100 square miles of territory and 5.3 miles per 10,000 inhabitants. Belgium has 30.3 miles per 100 square miles of territory and 5.5 per 10,000 of population. For France the figures are 12.1 and 6.4.

The railroads reporting for 1895 which had a single track mileage of 177,746 miles had 10,640 miles of second track, 975 miles of third track, 733 miles of fourth track and 43,181 miles of yard track and siding. The total track of all the railroads, official and unofficial, amounted to 236,894 miles.

Equipment.—The locomotive equipment amounted to 35,699 engines, and the cars in passenger service were 33,112; in freight service there were 1,196,119 cars; and in the companies' service 41,330. The number of locomotives increased in the year by 50, the number of passenger cars by 94; the number of freight cars decreased by 7,517. The Statistician gives us the caution that the existing law does not enable a complete compilation of railroad equipment to be made, and therefore his figures are not given as being strictly accurate, in classification at least. He is of the opinion that the apparent decrease in freight cars is to be accounted for in some degree by the increased use made of private cars.

Brakes and Couplers.—Taking the total equipment, that is, the 1,270,561 cars in service and the 35,699 locomotives, it is found that there are 362,498 cars and engines equipped with train brakes and 405,856 fitted with automatic couplers. The increase in the number of brake equipments during the year was 31,506, and in the number of vehicles equipped with couplers 51,235. It will be observed that almost one million cars remain to be equipped with power brakes and about 900,000 to be equipped with couplers, and the Statistician thinks that the figures do not indicate a rate of improvement which will satisfy the conditions of the law. It will be remembered that all locomotives and cars engaged in interstate commerce must be equipped for operation with automatic couplers, and that all locomotives and a sufficient number of cars to control the freight trains must be equipped with power brakes, by Jan. 1, 1898. It is obvious that if these conditions are fulfilled the makers of brakes and couplers will have pretty busy times for the next two years, but we may safely assume that if the free silver craze triumphs in this election the automatic appliance law will not be obeyed because it absolutely cannot be.

Employees.—The total number of employees of all grades directly in the service of the railroads amounted to 785,034, being 441 per 100 miles of railroad. This is the least number per 100 miles reported by the Commission. It is a slight absolute increase, that is, about 5,400 over the number of employees in 1894, but it is a decrease as compared with 1893 and 1892. In 1893 the total number of men employed was 873,602. The falling off, therefore, in the two years amounted to 88,568 men, notwithstanding an increase of pretty nearly 4,000 miles in length of line operated. The heaviest relative decrease apparently has been in the track force, although the hard times have affected all ranks in this way.

Returns on Capital.—Only 29.95 per cent. of the railroad stocks pay any dividends, and the average rate of dividends for all stocks amounted to 1.7 per cent. The average payment on the total railroad debt, that is, stocks, bonds and miscellaneous debt, amounted to 3.1 per cent.

As we have said, the stock paying any dividends amounted to only 29.95 per cent. of the whole. This fraction has been diminished gradually ever since the Interstate Commerce Commission began its work. In 1888, 38.56 per cent. of the total railroad stocks paid dividends. The two years following this proportion diminished; then in 1891, 40.36 per cent. of the stock paid dividends, when the diminution again began, and has progressed steadily since. The amount of non-paying stocks (70 per cent.) was, however, much greater in 1895 than in any preceding year. Last year 13¼ per cent. of the bonded debt paid no interest.

The number of separate roads in the hands of receivers was 169, being a decrease of 23 as compared with the preceding year. These 169 roads represented 37,856 miles operated, the decrease from the previous

year being 2,963 miles. The total capital of these receivership roads on June 30, 1895, was $2,439,144,503, of which about 926 millions was stock and 1,319 millions funded debt, the rest being current liabilities.

The gross earnings from operation in 1895 were 1,075⅛ million dollars, the operating expenses were 725¾ millions and the total income was 482 millions. After deducting fixed charges the available income amounted to 56 millions, and the total dividends paid were 86 millions, leaving a deficit of 30 millions. This fact should be read in conjunction with the figures of dividends paid which are given above. It will be seen that even that showing was fictitious; that is, that the meager dividends actually paid were not paid out of the year's earnings. The net income from working is less than for any year since 1890, except the year 1894.

The working expenses of the year were, as stated above, 725¾ million dollars. The saving in this item from the preceding year was about 5½ million dollars. It is not easy to compare the items of working expenses for 1895 and 1894, inasmuch as certain changes have been made in the method of accounting, involving certain new accounts and the transfer of certain accounts from one heading to another. The reader is doubtless already aware that beginning with July 1, 1894, the attempt to apportion working expenses between freight and passenger business was abandoned by the Commission, a change, which, of course, seems to us sensible, as we have always held that it was quite impracticable to make such an apportionment with sufficient accuracy to be of any use.

Certain new summaries appear for the first time in the report under review. These are given for the years 1894 and 1895 and present a further analysis of working expenses. The analysis for the year 1895 covers 57 items. For instance, maintenance of way and structures is divided into 10 items, maintenance of equipment into nine items, and conducting transportation into 25 items. If this careful analysis is maintained as time goes on, it will be possible to make pretty thorough and minute examination of comparative working expenses. At the same time we question if any very practical use can be made of such general averages.

Traffic.—In the year under review, the railroads of the United States carried 507¼ million passengers, being a decrease of 33¼ millions as compared with the year before. The passenger miles were 12,188½ millions, the decrease being over 2,000 millions. The passenger miles per mile of line were 68,573 in 1895 as against 81,333 the year before. This figure is given for the last six years, and the density of passenger traffic was a good deal less in 1895 than in either of the years reported. The freight carried in the year amounted to 696¾ million tons, the increase being 58⅛ millions; and the number of ton-miles was 85,227⅓ millions, the increase being 4,892½ millions. The ton-miles per mile of line also increased by 22,238 to a total of 457,252 ton-miles per mile.

The percentage of working expenses to income from operation amounted in the year 1895 to 67.48; the year before it was 68.14, and in 1893 it was 67.82. The average rate per passenger mile for 1895 was 2.04 cents. This was somewhat greater than in 1894, when, of course, the average fare was reduced by the World's Fair business. It was less, however, than for any year reported on by the Commission. The revenue per ton mile was 0.839 cent, which was the lowest figure ever given by the Commissioners. The Statistician says that had the rate of 1890 being received for the passenger traffic of 1895, the passenger revenue would have been about 15½ million dollars more than it actually was. Had the freight rate of 1890 been maintained in 1895, the freight receipts would have been nearly 87 million dollars greater. "From this it appears that there has been remitted to the people of the United States, as an annual charge for railway passenger and freight business, accepting the report of 1890 as a standard of measure, a sum in excess of 100 million dollars. It would seem that the railway managers would sooner or later be forced to observe the requirements of the Interstate Commerce act as a means to preserve the property placed under their control." We shall not now enter into any argument as to the effect of the Interstate Commerce act on rates, but would remind the Statistician that the railroad companies have been compelled to fight the Interstate Commerce Commission in the courts for the privilege of maintaining rates. He makes one statement which railroad officers and the great public should keep in mind, namely: "In no other industry perhaps is convertible property so small a per cent. of fixed investment, and in no other industry is so large a business carried on upon so small a banking account. The meaning of this statement is that no other industry is so dependent upon the stability of conditions and conservatism of management as the railway industry."

Signal Rules for Trains Approaching Crossings.

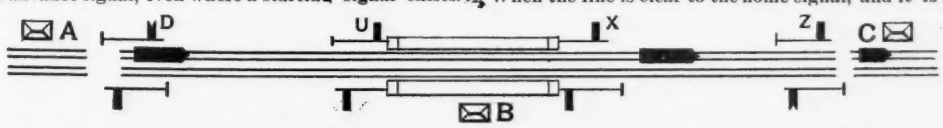
The crossing collision near Atlantic City on July 30 brought prominently to notice a marked difference between American and English practice in the management of the block system at junctions and crossings; and as the English practice, embracing the use of more thorough safeguards than we use, is undoubtedly the result of a careful study of the lessons of experience in that country, which experience has extended over a period of 30 years or more, it may not be out of place to compare the two methods once more. To this end we asked Mr. Arthur H. Johnson, formerly with the Johnson Railroad Signal Company, and now in England, to post us as to the present actual practice in that country. The English *rules* are very rigid, but they provide for their own suspension, under some circumstances, and as in train management the suspensions are often found to be so numerous as to make the language of the rules misleading, it is necessary to know to what extent the letter of the rule is actually followed before discussing the merits of any particular mode of working. Mr. Johnson, in reply to our question, writing from York, England, says:

I have received your letter of Aug. 27, containing an inquiry as to the actual practice of the English railroads in block working, more especially concerning the Clearing House rule which states that the rear of a train must be one-quarter mile clear of the home signal before "line clear" is given to the cabin in rear. You ask if this rule and the one following (which prescribes the precautions to be taken at cabins which are specially authorized to accept a train from the rear when the preceding train stands clear of the home signal) are rigidly carried out. They are, with few exceptions.

Of late years the tendency in this respect has been toward increased vigilance.

In a great many cases, amounting to not less than 50 per cent. on some lines, the stringency of the first-mentioned rule is modified by the reduction of the space interval to about 600 ft., or the distance between the home and starting signals.

There is, however, one line that absolutely forbids "clearing the rear" until the tail markers have passed the advance signal, even where a starting signal exists.



To illustrate this point more clearly, let *B* in the diagram represent a block cabin, between cabins *A* and *C*. While a train occupies the platform, *B* must not give the clear signal to *A;* but supposing the section between the advance signal *Z* and station *C* to be occupied, *B* can allow the platform train to draw up to the advance, and having put starting signal *X* to danger in its rear, may accept another train from *A*.

Of course neither the rules aforesaid, nor these remarks, apply to the cabins in proximity to terminal stations. The block system is still maintained at such points, in most cases, by various auxiliary appliances. For instance, under the Sykes lock and block, in such a case, a rear home signal would be added, between *U* and *D*, thus making four, and sometimes more "stop" signals, serving the one pair of rails. By appliances analogous to the rail circuit, these are converted into diminutive block sections, automatically controlled.

The fact is that no hard and fast rules can be applied, apart from the special dangers contingent to grades, shortness of block sections, etc. For instance, if there were a steep grade at *B* falling from *A* to *C*, the manager might and probably would issue special instructions, to be posted in the cabin, allowing the freedom before mentioned in the direction from *C* to *A*, but forbidding it from *A* to *C*. I will say without hesitation that the clearing House rules and the actual English practice would forbid the simultaneous approach at a grade crossing of two trains which could collide. One train would be kept back one block section until the other had cleared the crossing. The Clearing House code would allow the two trains to be brought up to the crossing to transfer passengers, but one would have to first be brought to a stand clear of the same. This is not a great hardship when the adjacent sections are short.

This ruling again would not apply to crossings where switches governing divergent lines (not derails) could be placed to form a safeguard, nor in the case of yard limits.

The above remarks apply both to telegraphic blocking and to "lock and block," as these are of course simply different means to the same end.

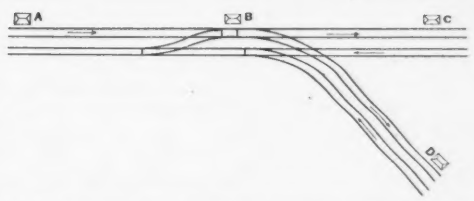
While an opinion formed on the result of an inquiry like that made by Mr. Johnson lacks the completeness of an official report, which gets formal statements from every road, his statement is to be accepted as giving a true view of present English practice.

The English rules, adopted by practically all the roads, read as follows:

4. *Line Clear or Giving Permission for a Train to Approach.*—Unless special instructions are given to the contrary the line must not be considered clear, nor must a train be allowed to approach from the signal box in the rear, in accordance with Rule 3, until the preceding train has passed at least a quarter of a mile beyond the home signal, nor until all the points over which the approaching train has to pass have been placed in their proper position, and the line is clear for at least a quarter of a mile ahead of the home signal.

Where the signal box in advance is less than a quarter of a mile ahead, permission for a train to approach must not be given to the signal box in the rear until the "train out of section" signal has been received from the signal box in advance.

After permission has been given for a train to approach in accordance with Rule 3 [that is, from the station in the rear] no obstruction of the line on which such train requires to run must be allowed until the train has been brought to a stand at the home signal, or has passed into the section in advance, or the "cancelling" signal has been received from the signal box in the rear. . . .



At junctions, except where otherwise provided, the approach of trains, which can cross or foul each other, is regulated as shown in the drawing above.

When permission has been given by *B* for a train to approach from *C* no train must be allowed to leave *D* until that from *C* has been brought to a stand at the home signal, or has passed through the junction for a distance of a quarter of a mile, or until the "train out of section" signal for the previous train has been received from the next signal box ahead if within that distance; nor in such a case must a train be allowed to leave *A* for *D* unless the junction facing points at *B* are set for *C*, and the line towards *C* is clear for a distance of a quarter of a mile beyond the junction points, or until the "train out of section" signal for the previous train has been received from the next signal box ahead if within that distance.

When permission has been given by *B* for a train to approach from *D*, no train must be allowed to leave *C* until that from *D* has been brought to a stand at the home signal, or has passed through the junction for a distance of a quarter of a mile, or until the "train out of section" signal for the previous train has been received from the next signal box ahead if within that distance.

When permission has been given by *B* for train to approach from *A* for *D*, no train must be allowed to leave *C* until that from *A* has been brought to a stand at the home signal, or has passed clear of the junction, or the junction facing points have been set for *C*, and the line toward *C* is clear for a distance of a quarter of a mile beyond the junction points, or until the "train out of section" signal for the previous train has been received from the next signal box ahead if within that distance.

When a train has been sent to the starting signal and the rear of the train is well clear of the junction, permission for a following train to approach may be given by the signalman to the signal box in the rear if the points are set for the following train to pass on to another line and that line is clear.

5. *Section Clear, but Station or Junction Blocked. (This signal must only be used where it is specially authorized by a note at the foot of these regulations.)* When the line is clear to the home signal, and it is necessary for a train to be allowed to approach cautiously in consequence of an obstruction existing ahead of the home signal, or from any other cause, the "be ready" (or "is line clear?") signal must not be acknowledged, in accordance with Rule 3, but the "section clear but station or junction blocked" signal must be given, and when this signal has been acknowledged, the block indicator must be placed to the "line clear" position. The signalman receiving the signal must (if the train has not already passed the home signal toward the starting or advanced starting signal) bring the train to a "dead stand" at the home signal, and verbally instruct the driver that the section is clear, but the station or junction ahead is blocked. A green flag by day and a green light by night must at the same time be exhibited to the driver, and the necessary fixed signals lowered to give permission for the train to proceed. The "train entering section" signal must then be given and acknowledged, and the block indicator placed at the "train on line" or other authorized blocked position. . . .

The substance of the meaning of these clumsy sentences is, to take a concrete instance, that when a Pennsylvania train fouls or has been given leave to foul, the crossing at Atlantic City a Reading train from Camden must not be permitted to pass Pleasantville until it has been brought to a dead stop at that place and the engineman informed by word of mouth that the crossing is not clear. It is needless to observe that the application of this English rule to the American practice mentioned would produce such a change as would make all the passengers wonder if the railroads had gone back to the methods of 1850.

We do not bring up the English practice at this time for the purpose of trying to decide, off-hand, whether it, or the American practice, is nearest right, but simply for the purpose of bringing it definitely to the attention of American readers. Do we want to modify our practice?

It will be observed from Mr. Johnson's statement that the average signal engineer in England would not employ a switch to throw a train off from the main line on approaching a danger point unless he could throw it upon a track which would give the train 80 rods to stop in. Whether he would look more favorably upon a sand track than upon one of our regular wild-west "hold-up" devices known as a derail, it is impossible to say. The reported experiments with sand tracks in Germany have not dealt, so far as we have observed, with express trains drawn by top-heavy engines, running at 75 miles an hour. Unless a sand track is available, that is, is safer than a derailing switch, our English friends would undoubtedly insist, at a place like the Atlantic City crossing, that their rule, to keep trains back a whole block, is the only safe method. And it is to be remembered that we have in this country a good many crossings where the intro-

duction of a derailer would be as difficult as at Atlantic City; and they are not all in swamps or on trestles, either.

It will be observed from Mr. Johnson's statements that the exceptions to the English rule are based on a variety of grounds. The first place mentioned where the rule does not apply is a terminal station This is elastic, because some very large stations are not terminals, and some terminals are as small and as much in need of all the usual safeguards as way stations where the rule is rigidly applied. Another exception is where the grade is so great an obstacle to high speed that it is virtually assumed that moderate speeds will *never* be exceeded. This theory is weak, to the extent that very light, fast trains are run. We have recently had accounts of numerous English trains traveling 50 miles an hour up steep hills; and year by year we are having increasing numbers of trains that make that rate up a 50-ft. grade with no trouble whatever. Another exception mentioned is "yard limits." As limits of this kind are common at country as well as at city stations, this exception is harder to classify than either of the others.

It seems to us that one conclusion to be reached from a consideration of these features of English signaling, is that their rules are a good deal like ours, in the fact that they are in a large degree based on the so-called lessons of experience without very close adherence to systematic theories based on a thorough study of all of the conditions that have to be dealt with in moving trains. The most unscientific feature of our methods of train-running is that which permits exceptions to rules, without making clear to the enginemen and trainmen why they are made. We put up costly and elaborate signals and then discredit the rules under which they are supposed to be operated, by permitting the men to use and rely upon hand motions. The rule is made that a semaphore is to be used as a positive stop signal, and then great pains are taken, by prescribing other safeguards, to show that dependence is not to be placed on the efficacy of a horizontal semaphore blade to stop a train. Why should two stop signals be used to protect a train at a junction in the country, and only one in London? It may be true that enginemen take more risks or keep their minds less alert where junctions are encountered once in 20 miles, than where they encounter them every half-mile; but why should this be permitted?

The very least that can consistently be done in this matter is to prescribe rigid speed limits everywhere, and then let the process of (morally) propping up signals be conducted in accordance with those limits. Where it is deemed necessary to protect every train by two stop signals, 600 ft. apart, limit all trains to, say, 40 miles an hour; where the stop signals are 1,500 ft. apart the limit could be, perhaps, 75 miles an hour; and where they are close together, or there is only one stop signal, make the limit 20 miles an hour. By such an arrangement there would be at least a show of consistency and the whole theory of the regulations could be made plain to every engineman. With the empirical regulations now common, every engineman forms theories to suit himself, some of them based on a true conception of the facts and some otherwise. A speed limit is the only regulative element that can be applied with any approach to simplicity. Where rules are made consistent in every other respect, but are tacitly relaxed for the "Limited" or the "Flyer," there is no use in trying to enforce systematic obedience.

But it should be remembered that every so-called safeguard of the nature here considered—whether recognized formally in print as in England, or by sufferance, as in many cases in this country—detracts from the integrity and therefore the value of the stop signal. The fundamental idea of a horizontal semaphore blade is that *every* train shall stop before passing it, whether the heavens fall or continue hung up; whether the train is in the habit of traveling 75 miles an hour or 25; whether there is a distant signal or no preliminary warning whatever. We, on this side of the Atlantic, have, theoretically, adhered to this fundamental idea more thoroughly than have the English; have we so adjusted our practice to it as to insure the necessary degree of safety?

British Railroad Statistics in 1895.

Last week we gave some figures from the Board of Trade returns of railroad working in the United Kingdom in 1895. We return to the subject now especially to bring out a few points that may with interest be compared with the figures for the railroads of the United States, collected by the Statistician of the Interstate Commerce Commission.

The length of railroad open in the United Kingdom is 21,174 miles, of which 11,426, a good deal more than half, is double line or more. As some of the companies have given particulars of the mileage of treble and quadruple line, we can say that there are not less than 150 miles of treble and 571 miles of quadruple track. No attempt has ever been made to ascertain the total mileage of track in sidings and yards, but it must amount to many thousands of miles more, and, indeed, in the case of the Lancashire & Yorkshire, the mileage of siding is 708½ miles, largely exceeding that of running line. This company is, indeed, unique in the railroad world. It has only 530¼ miles of line, but of these 476¾ are double and 32 quadruple. The company, that is, while credited with only 530¼ miles of line, actually has built and maintains no less than 1,811¼ miles of track. If, however, we consider the main line only of the New York Central we find a still more remarkable proportion, as may be seen in the review of the annual report of that company in this issue. Its paid-up capital is £53,645,000, or more than £100,000 per mile. Last year it ran 16,563,000 train miles, and carried (including season-ticket holders) over 60,000,000 passengers, and nearly 19,000,000 tons of goods and minerals at a total cost of £2,672,000. The gross receipts were £4,713,000 (say $43,000 per mile of road), so that the net earnings were £2,040,000—roughly equivalent to a return of 4 per cent. on the entire capital.

The capital of the English railroads reached for the first time in 1895 the figure of one thousand millions sterling—to be exact £1,001,110,221. Per mile of line open the capital is £47,280, a figure which is increasing but slowly in the last few years, during which the vast expenditure by the great English and Scotch companies on their main lines has been roughly balanced by the opening of some 400 or 500 miles of light lines in the West of Ireland which have only cost about £5,000 per mile. It should be noted that of the total capital as given above £88,500,000 is described as nominal additions only, due to consolidations or conversions of stock, so that the actual investment of cash would seem to be about 912 millions. But this figure is by no means reliable. It is only in the last few years that nominal additions have been recorded, and even now no account is taken of the absorption of small companies by their great neighbors. Quite recently, for instance, the Great Western has brought up two small independent companies paying in the one case £35 and in the other £160 for each nominal £100 of their ordinary stock, Again, there is no record of the vast sums which, over a long series of years, the richer and more conservative companies have devoted out of revenue to capital purposes.

But taking the capital as it now appears we find that the total ordinary capital was in 1895 £364,000,000, of which £46,000,000 received no dividend, £29,000,000 got 2 per cent. or less, £40,000,000 3 per cent., £27,000,000 4 per cent., £52,000,000 5 per cent., £105,000,000 6 per cent., and £57,000,000 7 per cent., or over. The preference capital amounted to £253,000,000, £14,000,000 of which received no dividend, while almost the whole of the remainder received between 3 and 5 per cent. Guaranteed capital amounted to £102 millions, practically the whole of it receiving 3 and 5 per cent. also. Finally, there were £280 millions of loans and debentures, £131,000,000 at 3 per cent., £93,000,000 at from 3 to 4 per cent., and £53,000,000 at from 4 to 5 per cent.

An interesting contrast to the general prosperity of the railroads of Great Britain is given by the returns of the 230 miles of light railroad in Ireland, which were constructed mainly with public money and are still worked by small local companies. These small companies, eleven in number, ran 572,000 miles, nearly the whole with mixed trains, and spent £59,000 in earning £54,000. But as they carried one million passengers and 122,000 tons of goods and coal, they doubtless rendered great service to their districts. The interest on the capital invested in these lines comes to between £50,000 and £60,000 per annum, so we may roughly say that out of every shilling paid for carriage on these lines, one-half is paid by the Irish peasant himself and the other half by local or national taxation.

Annual Reports.

New York Central & Hudson River.—The report of this company for the year ending June 30, 1896, was issued late last week. The total miles of road operated were 2,395. This includes 819 miles of the New York Central & Hudson River proper, 495 miles of the West Shore, 624 of the Rome, Watertown & Ogdensburgh and 181½ of the Mohawk & Malone. The length of track proportionately to miles of road of the New York Central & Hudson River proper is no doubt greater than on any other railroad in the country. The total miles of main line from New York to Buffalo are 441.75. This is all double-tracked, 317 miles of it has a third track and 287 miles has four tracks, and there are 872 miles of sidings. The total track, therefore, on the main line amounts to 2,360 miles. The total track of the whole system, including the lines leased, is 5,340 miles.

The construction and equipment account aggregates $158,617,691. It was increased during the year by $886,607, of which $552,465 was paid for the new shops and yard at Depew, and $166,429 for the new passenger station at Syracuse. The cost of road and equipment per mile owned stands now on the ledgers at $193,566. All expenditures for additions and improvements during the year, other than the $886,000 mentioned above, were charged to operating expenses. The capital stock of the company stands unchanged at 100 million dollars, and the funded debt is $70,377,333. The grand aggregate of assets according to the general balance sheet is $194,706,628.

The main results of operation were as below:

	1896.	Increase.
Gross earnings	$45,144,967	$2,655,430
Working exp. (67.46 per cent.)	30,455,570	1,645,127
Net earnings	$14,689,397	$1,010,303
First charges	10,615,604	88,924
Profit	$4,043,793	$921,379
Dividends (4 per cent.)	4,000,000	339,991*
Surplus	$43,793	$1,261,370

* Decrease.

The surplus of $43,793 is compared with a deficit last year of $1,217,577, and in 1894 there was a deficit of $786,340. The dividends for this year were, it will be observed, at the rate of four per cent.; the year before they were 4½ per cent., and in the year ending June 30, 1894, they were five per cent.

The earnings from freight amounted to $25,984,710, the increase over the previous year being $1,716,000. The earnings from passengers were $13,705,021 and the increase was $739,909. All other items of earnings increased except interest and miscellaneous, in which there was a small decrease.

Expenses charged to maintenance of way and structures amounted to $5,327,696, an increase of $930,706. Maintenance of equipment aggregated $4,639,017, and the increase was $387,549. It will be observed that these items indicate the tendency which was strong in the early part of the year to spend more money in maintenance. The traffic expenses, which amounted to $17,667,000, increased only a little more than $6,000 as compared with the former year, and yet the tons one mile increased 486 millions (to 4,102,000,000) and the passengers one mile increased 38 millions (to 724,000,000). With so considerable an increase of traffic and so slight an increase in traffic expenses there must have been pretty good management; in fact, the average freight train load in the year just ended was 293 tons and in 1895 it was 278.

The increased passenger receipts are due entirely to the increased traffic, the rate per passenger-mile remaining the same, namely, 1.89 cents. The increased freight receipts are due to the large increase of traffic, the rate per ton-mile having fallen from 0.73 to 0.67 cent, which, by the way, is the lowest average rate for any year in the company's history, not excepting the year of the war with the West Shore. Inasmuch as the report contains no text or comment from the President or Chairman of the Board, we have no suggestion as to what they think of the present situation, nor any forecast of the future.

The Paris, Lyons & Mediterranean Railroad has followed the example of the Western Railroad in introducing in Paris a baggage express service with arrangements equivalent to our "checking at the house." A special company has charge of this business The intending passenger must inform this agency, which has several branch offices, *at least 24 hours beforehand*, of the journey he wishes to make, the number and class of tickets, the train by which he will start and the number of pieces of baggage which he wishes registered, together with his name and address. To him is given a consecutively numbered receipt; the agency calls at his residence for the baggage, has it weighed and registered at the station, gets the tickets and the baggage receipt (equivalent to our check), puts them in an envelope numbered like the receipt given to the passenger, and marked on the outside with the amount to pay, consisting of the price of the tickets, the charge for excess weight of baggage (common, as only 66 lbs. goes free), the fee for registering (2 cents per piece), and the agency's charges. This envelope is kept at the agency's office in the station, where the attendant gives it out on presentation of the receipt with the corresponding number and the payment of the bill. The passenger has then nothing further to do than to go to his train. The charges of the agency in Paris are six cents for every 22 lbs. of baggage, but a minimum of 50 cents. In the few other stations where it has been introduced (Marseilles and the Mediterranean health resorts), the minimum charge is 40 cents, and the rate four cents per 22 lbs. This method has been in operation more than six months, and the number of passengers patronizing it has increased steadily. It will probably be introduced at other stations, especially at summer resorts and watering places.

TRADE CATALOGUES.

Water Tube Boilers.—The Almy Water Tube Boiler Co., 178 Allen avenue, Providence, R. I., issues the fifth edition of its pamphlet on water tube boilers. The pamphlet contains a description of the material, design and construction of these boilers with illustrations and

dimensions. The same company advertises an automatic feed-water regulator patented in 1895 and 1896.

An Electric Motor on the Manhattan Elevated.

A public trial of electricity as a motive power on the Manhattan Elevated Railroad was made on Monday of this week on the Thirty-fourth street branch of the Third avenue line. The road is only a few blocks in length, connecting the Thirty-fourth street station with the Brooklyn ferry.

The motor was built on the truck of an old dummy-engine, according to the designs of Mr. J. B. Entz and is only experimental. It is 18 ft. in length, 8 ft. high, with 28-in. drivers, and weighs 39,000 lbs. The motorman's cab is in the middle and from this compartment the sides of the motor slope down until it is but 3 ft. high at each end. It is arranged to carry 256 cells of storage batteries, but only 56 are put in at present, the remaining 200 being on a platform near one of the terminal stations and connected with the third rail. The accumulators, which were made by the Electric Storage Battery Co., of Philadelphia, weigh 80 lbs. each, and every cell contains seven plates, three being positive and four negative. This company furnished the batteries for the Madison Avenue line which have been in successful operation on that road in the upper part of New York since November, 1895. Two 125 H. P. motors of the G. E. 2,000 type are used and are made to run on a 700-volt circuit. They are of exactly the same type as those which form a part of the equipment of the cars on the Nantasket Beach branch of the New York, New Haven & Hartford.

The third rail, which has been laid beside the tracks on the Thirty-fourth street branch, is placed outside of the wooden guard timber and stands 10 inches above the regular rails. This rail conducts the current from the power-house to the motor, the connection being made by two steel shoes which reach from the lower edge of the motor and clasp over the charged rail. When more electricity is furnished than the motor can use, the excess is sent into the accumulators. When less is furnished than is needed the storage batteries are put in the circuit so that they will give the requisite amount of current to propel the car.

This experiment is being made by the Electric Storage Battery Company without cost to the Manhattan Company, and it must not be taken as having any significance whatever, other than as an experiment.

Asbestos.

Of all the strange anomalies produced in the laboratory of nature in geologic times, none is more interesting than the curious mineral asbestos. It seems to occupy a place midway between the vegetable and mineral kingdoms; for though a compact and solid rock, i possesses fibres as smooth and soft as silk, which can be spun and woven like organic fibers.

Its peculiar structure caused it to be regarded formerly as of vegetable origin, but it is now understood to be a metamorphic form of certain minerals, principally hornblende and serpentine, which have crystallized with a fibrous structure by slow cooling in the presence of water. It occurs in veins generally associated with serpentine, though many forms of little value are found in limestone and other rocks in all countries. Italy and Canada furnish at present the principal supply for industrial purposes. The Italian asbestos was the only variety known to the ancients, and possesses very long fibers which are, however, difficult to manipulate. Canada produces in abundance the most useful qualities, and is the chief source of supply.

The peculiar fire-proof qualities of this mineral were known to the Greeks, who gave it the name asbestos, meaning incombustible. They separated the fibres by hand, and wove them into cloth, in which the bodies of their illustrious dead were wrapped when cremated, to preserve the ashes. Charlemagne was said to have an asbestos table-cloth with which he astonished his guests by throwing it into the fire, where it was cleansed without burning. Marco Polo mentioned a cloth shown him in Tartary, which he was informed was made of the skin of the salamander, but which he found to be woven from a fibrous stone. Many wonderful stories are related of its use in the middle ages to astonish the ignorant through its supposed supernatural powers, and instances are cited in later times of its being made into fire-proof dresses, gloves, etc.; but it continued to be a mere curiosity, its valuable properties being turned to no practical use until 25 years ago. It remained for an American to make known the great possibilities which lay dormant in this hitherto scarce and almost unknown substance, and to lay the foundation of one of the most important industries of the world.

The credit of discovering the commercial uses of asbestos rightly belongs to Mr. H. W. Johns, who in 1867, having been dissatisfied with the perishability of hemp and other vegetable fibers, which he was using in a cement, became alive to the need of a fiber stronger and more durable than any yet known. In a search for this he came across an article in an encyclopedia on asbestos, and immediately became convinced that here was the fiber he was looking for. He then set about discovering the deposits which were said to exist in Staten Island. These, when found, though brittle and of poor quality, answered the first purpose; but slight experimenting with the new mineral opened to his imagination wide possibilities of its future usefulness, and having a firm belief that nature provides in sufficient quantities all substances needed by man, he at once took steps toward bringing to light the hidden treasure which he was sure existed.

In order to elicit information concerning other deposits he advertised his asbestos cement in the leading scientific and other newspapers, adding a description of the characteristics of the curious mineral, with the result that letters of inquiry containing samples of asbestos began to pour in upon him from all parts of the country. These, however, were all too brittle to be spun or used for the more valuable purposes. Italian asbestos was then tried, but proved very expensive and unsuitable in many respects. The interest thus awaked in the subject led in a few years to the opening of the Canadian mines, which supplied in abundance the desired quality, and rendered possible the many applications of it which have been made.

Asbestos has become a necessity of our daily life, and its uses are innumerable. It sheathes our houses, covers our furnace pipes, appears in the form of rugs and blowers before our fireplaces, takes the place of paper for covering our walls, and finds its way into our kitchens in the form of stove mats, baking paper and iron holders.

Every theater is required to be provided with a curtain of asbestos. But its most important uses are in mechanical and electrical lines—here we find it as a packing in steam engines, a covering for steam pipes and boilers, firings—in fact asbestos plays a very important part in railroad equipment. Fire felt for lagging locomotive boilers and covering train pipes is the only material upon the market which fulfills all the requirements of these purposes. It consists of asbestos fibers formed into a felt-like removable fabric possessing the highest heat-insulating power, unaffected by the excessive vibration, and practically indestructible by moisture or other injurious effects. The vulcabeston used in the Westinghouse air-brake pumps is composed largely of asbestos, and packings of asbestos in sheet or rope form are very generally employed for railroad, marine and stationary steam engines.

In combination with other substances it forms the standard electrical insulating material of the world. Electric car heaters are in common use—the "electrotherm," a flexible heating pad for use in place of hot-water bags and poultices is one of the latest valuable inventions.

To-day the company of which Mr. Johns is the head controls the main sources of the supply of asbestos and all the important patents covering its applications, and although a wide harvest has already been reaped from the apparantly unimportant discovery 30 years ago, the industry may still be said to be in its infancy.

TECHNICAL.

Manufacturing and Business.

Riehle Bros. Testing Machine Co., of Philadelphia, has shipped to the Russian-American Manf g. Co., Nijni Novgorod, Russia, a 100,000-lb. automatic and autographic vertical screw-power testing machine, and a double-headed specimen miller. They have also delivered a 200-000-lb. testing machine to the Schoen Pressed Steel Co., and to Jones & Laughlins, of Pittsburgh. They are building a 300,000-lb. wire rope testing machine for John A. Roebling's Sons Co., Trenton, N. J.

The Youngstown Bridge Company, of Youngstown, O., is just completing a two-span truss bridge for the Pennsylvania Company, over the Tuscarawas River. Several other bridges, also three girder spans, for shipment to Russia; a furnace building for the new plant of the Puxatawney Iron Company; and among other structural work, several buildings for mining plants in Arizona are being built by the Youngstown shops. Work is also under way on the seven-span bridge for Lewiston, Me., consisting of 85-ft. plate girders, carrying granite pavement.

The Hovey Drawbar Stop Company, of Owosso, has been incorporated in Michigan. Capital, $30,000.

Application has been made for the appointment of a Receiver for the Laconia Car Company, Laconia, N. H. The liabilities of the company are about $400,000.

The Standard Valve-Gear Company, of Jersey City, was incorporated in New Jersey last week. Capital stock, $300,000. The company proposes to make and sell engines, cars and all kinds of vehicles. Charles S. Furman, of Philadelphia, is one of the incorporators.

The J. A. Fay & Egan Company, of Cincinnati, announces that it has dissolved all relations with Mr. Charles A. Gilbert, formerly a salesman. The Atlanta office of the company, 36 West Alabama street, is now in charge of Mr. Eugene Donnely.

The Baltimore & Ohio has contracted with William Skinner & Sons, of Baltimore, to build for the road 10 freight lighters to be used in New York Harbor. Five are to have heavy masts and hoisting gear, and five are to be covered, being intended principally for carrying fresh meat. These vessels are to be 80 ft. long, 28 ft. wide, and 8 ft. deep.

The General Electric Company has issued a notice warning the public against an imposter calling himself Charles C. Caldwell, who has falsely represented himself as being connected with the General Electric Company.

Allen & Co., 603 Pabst Building, Milwaukee, Wis., are offering for sale about 20 million feet of white oak, and 8 million ft. of yellow poplar, in Eastern Kentucky. The land is mostly untouched by the axe.

Iron and Steel.

Application was made on Oct. 3, to the Courts for the formal discharge of the receivers of the Pottstown Iron Co. and the transfer of the property to the shareholders. Under the terms of the reorganization the unsecured creditors, whose claims aggregate $800,000, will accept in payment thereof the promissory notes of the company for 50 per cent. of their respective claims, and the other 50 per cent. in a new issue of bonds secured by a consolidated mortgage to the Equitable Trust Co., of Philadelphia, as trustee. These bonds, amounting to $800,000 and bearing five per cent. interest, are made payable 10 years after date, with the option on the part of the company to take them up before their maturity. Other creditors of the company, whose claims amount to $190,000, are secured by $246,000 of the general mortgage bonds.

A recent report that the mills of the Cleveland Rolling Mill Co. had been closed, throwing 4,500 men out of employment, has been denied by President William Chisholm. The company is now running under a largely reduced force, employing only about 2,500 men, and is working only on orders as received.

Haselton Furnace, of the Andrews' Brothers Co., of Youngstown, O., will be blown in about the middle of October. The furnace has been out of blast for some months, during which time new blowing engines have been put in and other extensive repairs made.

The Monarch Iron Co., of Duluth, Minn., has been incorporated with a capital stock of $200,000. The incorporators are S. W. Eckman, Arthur Howell and T. W. Wahl, all of Duluth.

The Burden Iron Works, Troy, N. Y., resumed operations on Sept. 28, employing about 1,500 men. It is expected that the works will shortly be put on full time.

Warwick furnace, Pottstown, Pa., has been blown out for repairs. During its last campaign the furnace turned out 202,000 tons of iron. The capacity will be increased by 100 tons per week. It is expected that the furnace will be blown in again by the first of December.

It is reported that a conference was held in Chicago, on Oct. 5, between representatives of the Carnegie Steel Co., Illinois Steel Co., and others, and that the result of the conference will probably be an immediate advance in the price of Bessemer steel billets.

It was officially announced on Oct. 6 that practically every department of the Cambria Iron Works would close down on the following day, for an indefinite period, throwing 3,000 men out of employment. A part of the plant was closed down more than three weeks ago.

Torpedo-Boat Contracts.

The recommendations of Chief Constructor Hichborn and Engineer-in-Chief Melville in regard to the award of contracts for the 30-knot torpedo boats have been indorsed by Secretary of the Navy Herbert and three boats will go to the Bath Iron Works, of Maine, and to the Union Iron Works, of San Francisco, as stated in the *Railroad Gazette* last week. In regard to the awards of the smaller boats, the distribution has been somewhat changed from the original recommendations: Wolff & Zwicker, of Portland, Or., will build two 22½-knot boats, as at first stated but the Herreshoffs, instead of building three 20-knot boats, will build one of 22½ knots and two of 20 knots. The Columbia Iron Works, of Baltimore, will build one, instead of two 20-knot boats, and Hillman Bros., of Philadelphia, will build one 20-knot boat, as was the original plan. This arrangement provides for one less boat than was originally intended, but has the advantage of providing an additional 22½-knot boat. Contracts for the three 30-knot boats have already been executed.

Calculating Riveted Joints.

In the July number of the *Journal of the Association of Engineering Societies* is a paper on "Riveted Joints," by Mr. Joseph R. Worcester. In it the author states that it is surprising, in view of use of so much riveted work in bridges and buildings, that we are still using the same methods of proportioning joints as was common practice fifteen years ago. Practice considers only the shearing strength of the rivet, or the bearing value of the rivet against the metal opposing it. In proper riveted work the writer holds that neither one nor the other of these strains is exerted to any extent. Rigidity is the thing which marks the riveted joint form of construction. The way that it is shown that it is neither bearing nor shearing strength that gives this rigidity to riveted work is that when a rivet is driven hot it is supposed to entirely fill the hole, which is usually made of $\frac{1}{16}$ in. to $\frac{1}{8}$ in. greater in diameter than the rivet. This is imperfectly accomplished. A magnifying-glass, or the point of a needle, will show in a section cut through a riveted joint that the contact between the rivet and the plates is nothing like as close as that between the heads of the rivet and the surfaces of the plates, or between the various plates held together. It is this fact of there being little play around the rivets which prevents their acting either by bearing or shear until there has been a little slip between the plates. Up to the point when the slip occurs the force which prevents motion must be the friction caused by the pinching together of the surfaces by the rivet heads. That this frictional resistance must be the force upon which we depend for the rigidity of our riveted structures has been shown in various ways, as by the tests made at the Watertown arsenal in 1886. The experiments

made in France two years ago by M. Dupuy are cited as showing the same thing. The author gives some of the conclusions of M. Dupuy, among which it is said that the resistance to slipping of riveted plates increases as the limit of elasticity of the metal from which the rivets are made increases, and states that the metals used in making rivets should have an elongation of at least 12 per cent. for iron and 18 per cent. for steel. The writer says that it appears from tests that, while the thickness of the metal against which the rivet bears plays little part in the frictional strength of the joint, it seems necessary to get a tolerable length of rivet before the clamping effect can be fully developed. The rivets should not be closer together than three diameters, center to center, under which circumstances the fractional action seems to work to advantage. The paper recognizes a number of objections to this method of calculating, the main one of which is want of tightness of the rivet. And it also states some of the advantages such as simplicity and comparative accuracy. Comparative accuracy is claimed on the ground that while we may not be able to determine exactly the frictional strength of a rivet as long as it actually holds, yet we cannot gain much by considering the two other functions, bearing and shear, which do not really act at all. Hence the question arises, whether it is not possible to adopt specifications based upon friction, which will give more perfect results than those attained by using bearing and shear.

Recent Harbor Work.

Brunswick, Ga.—Work on the deepening of the outer bar under the government contractor, Col. C. P. Goodyear, by the novel method of blasting dynamite cartridges in heavy charges, is progressing rapidly and very favorably. The navigable depth is now over 24 ft., resulting in a large increase of the tonnage at this port, and the channel is of a permanent character.

Galveston, Tex.—Dredging between the jetties still continues to give increased depths. The last survey (Aug. 25-27) shows only a few spots having a slight draft as 24¾ ft. M. L. W., while some of the depths are as great as 30 ft. The channel extends in a straight line from the lightship to the outer buoy and lies about midway between the jetties, which are 7,000 ft. apart. The north one is 25,110 ft. long and the south jetty, 35,690 ft.

Aransas Pass, Tex.—The Aransas Pass Harbor Company signed a contract on Sept. 12, with Col. C. P. Goodyear for the extension of the second part of the stone rip-rap breakwater at this entrance. The bar has been reduced to half of its original width between the 20-ft. contours and the velocity of the ebb currents has been doubled so that the sill of the old government jetty obstructing the channel is now partially uncovered. Work will begin at an early date.

Philadelphia, Pa.—Specifications are being prepared for the re-dredging of the Delaware River from Gloucester and Greenwich Point, Philadelphia, down to and including the Mifflin Bar. This work will be under the control of the city authorities, subject to the approval of the Secretary of War. The bar at the mouth of the Schuylkill will also be advertised at an early date.

Metal Cars.

The Universal Construction Co., of Chicago, is proceeding steadily in the work of developing metal car construction. The company is bringing out designs for refrigerator, stock and hopper cars, and has recently received inquiries from South America for designs of metal cars. The company is building a flat car on the Pennock plan modified and somewhat simplified, and is operating gondola cars and ore cars carrying from 68,000 lbs. to 89,000. One of the company's steel cars recently took 80,120 lbs. of structural steel from Chicago to St. Paul for use in the Northern Pacific office building, for the steel work of which the Construction Company has the contract. The car was hauled on one of the fast merchandise trains, making the journey in 27¼ hours, and the load arrived in good order.

A New Torpedo Boat Launched.

The first of the three torpedo boats which have for several months been under construction at the ship yards, Columbian Iron Works, Baltimore, for the United States Navy was lauched on Oct 1. The new boat will be known as Torpedo Boat No. 3. She will be required, under penalty, to make a speed of 24½ knots an hour, and maintain that pace for two consecutive hours. No premium, however, will be allowed in case the speed is exceeded, as in the case of the cruisers built by the Columbian Company. No. 3, when completed, will cost about $100,000. She is of the turtle-back pattern, and will be heavily armored. The engines will be of the twin-screw pattern, capable of 2,000-H. P. The high-pressure cylinders aft in the starboard engine and forward in the port engine, will give the vessel great speed advantage. The two boilers will be of the Mosher pattern. The total grate surface will be 95 sq. ft.

The boat is 166 ft. long on the water line, and will have a breadth at load water line of 16 ft., and a displacement of 138 tons. She is built entirely of steel, galvanized below the water line. Fire-proof woodwork will be used in the engine and boiler rooms.

Tests of Transformers of Moderate Capacities.

The *Bulletin of the University of Wisconsin* for August contains the results of a complete test of modern American transformers as made by Arthur H. Ford, B. S., Fellow in Electrical Engineering, University of Wisconsin. There is an introductory note by Professor Jackson, calling attention to the vital importance of the subject in electric lighting. Twelve transformers were tested, where alternating currents were used. Twelve transformers were tested, ranging in capacity from 1,000 to 10,000 watts, and three methods of measurement were tried for obtaining the losses. First, the opposition method of Ayrton & Sumpner; second, the wattmeter method for measuring the power absorbed and delivered by the transformer; third, the method of Dr. Sumpner. The results of all the tests were plotted on cross section paper, which are reproduced in the *Bulletin*. The results of the test show, first, what the most noticeable difference in the transformers is in the iron losses; second, that those transformers in which the iron loss is small give nearly as good an efficiency on a frequency of 60 cycles per second as one of 125; third, that transformers giving constant current when their primaries are at constant pressure will work only at a frequency for which they are designed if the magnetic leakage is depended upon to keep the current constant; fourth, that the surface of the transformer core and exposed portion of the coils should measure at least 5 sq. in. for each watt loss at full load. The complete tables of the results show that the cheapest transformer is not always the most economical, and that transformers which do not meet the insulation and heating guarantees are unsafe to use upon commercial electric lighting or motor circuits, while those which do not meet the iron loss regulation, and exciting current guarantees, are wasteful.

Iron Ore Mining in 1895.

In a recent article in the *Iron Age* statistics are given of the iron ore production of the United State for 1895. These figures are taken from the annual report on iron ores by John Birkinbine, for the forthcoming volume of *Mineral Resources*. The distribution of the production by states in 1895 continued nearly in the same relations as in 1894, being as follows, for states producing over 500,000 tons each:

State.	Production, tons. 1895.	Per cent. increase over 1894.
Michigan	5,812,444	31.50
Minnesota	3,865,453	30.25
Alabama	2,199,390	47.30
Pennsylvania	900,340	60.21
Virginia	712,241	18.60
Wisconsin	649,351	86.86
Tennessee	519,796	77.51

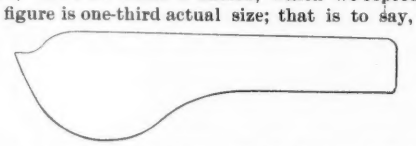
The iron ore product of the Lake Superior mines for 1895 was 10,268,978 tons, representing nearly two-thirds of the total production of the United States for that year, and being double the maximum output of the Bilbao district of Spain. The most remarkable increase has been shown in the Mesabi Range; the production from that district being in 1892, 29,245 long tons; in 1893, 684,194 long tons; in 1894, 1,913,234 long tons, and in 1895, 2,839,350 long tons.

The total production of iron ores and pig iron in the United States during the past seven years is given in the following table:

Year.	Total iron ore production. Long tons.	Total pig iron production. Long tons.
1889	14,518,041	7,603,642
1890	16,036,043	9,202,703
1891	14,391,178	8,279,870
1892	16,295,666	9,157,000
1893	11,587,629	7,124,502
1894	11,879,679	6,657,388
1895	15,957,614	9,446,308
Average	14,409,550	8,210,202
Total for seven years	100,856,850	57,471,413

A Car-Window Opener.

A correspondent writes that on the South Side Elevated road in Chicago each brakeman carries a "window raiser," and he sends a sketch, which we reproduce. The figure is one-third actual size; that is to say, the



lever, which is made of ¾ in. lumber, is about 7 in. long. We are glad to see that the suggestions of the need of a more effective device for opening the windows of passenger cars in the summer, which have been published in the *Railroad Gazette*, have borne some fruit. When a window sticks by reason of carelessness in varnishing the casing, or in consequence of swelling in damp weather, the passenger naturally looks around for a jimmy or some other suitable instrument with which to pry up the window, but he is not likely to find anything. The stick, with a metal tip, used for opening the ventilators in the roof quickly gives way when tried on a window, and the wrenches or keys used to turn the steam on and off are equally ineffective. These and stove pokers are far too brittle for such severe service. Where all the cars and car windows on a road are exactly alike, a tool like that of the South Side road is just the thing; but where some sashes have projections and other indentations, and where they are of different sizes, a single simple lever does not always answer, and we feel constrained to again recommend the very ingenious device of Colonel Marjoribanks. We have no doubt that the Colonel will cheerfully acknowledge the merits of the symmetrical design which we now illustrate and will give the Chicago inventor the benefit of his good will and the free use of his patents.

The Danube Ship Canal.

Removal of the obstruction in the Danube known as the Iron Gate, between Alt-Orsova, in Hungary and Gladova, in Servia, has been finally accomplished, and the river was opened to navigation on Sept. 27, with elaborate ceremonies by Emperor Francis Joseph. This canal through the Iron Gate is about two miles long, 260 ft. wide, and 10 ft. deep, and the Danube will now be navigable for the largest river steamers from Vienna to the Black Sea. It will undoubtedly develop the Danube traffic to a large extent, for the inconveniences of the obstacle were very serious; it often being necessary to disembark all the passengers and luggage, and take them across either in small boats or by road.

New Steamships for the North German Lloyd.

The North German Lloyd Steamship Co. proposes an addition to its transatlantic service of six new twin-screw steamships, two of which will be express steamships, the other four being intended for the regular passenger and freight service between Bremen and New York. The express boats are now being built; one at Elbang and the other at Stettin, but the other four, called by the company the "Barbarossa class," are to be completed first. They are the Friedrich der Grosse and Konigin Luise, being built by the Vulcan Shipbuilding Co., Stettin; the Barbarossa, by Blohm & Voss, Hamburg, and the Bremen, by F. Schichau, Dantzig. The four boats are alike in size and in most of the important particulars; their dimensions are: Length, 525 ft. between perpendiculars, or 550 ft. over all; beam, 60 ft.; depth, 34 ft.; tonnage, 10.000 tons register and 20,000 tons displacement; draft, 28 ft.; cargo space, including steerage decks, 388,500 cu. ft. The cabins accommodate 100 first-class and 76 second-class passengers. The motive power consists of two quadruple expansion engines on four cranks. The two engines of three of these steamers will develop 7,000 indicated H.P., with a speed of 14 knots, but the fourth steamer, the Bremen, will receive engines of 8,000 indicated H. P., giving a speed of 15 knots. The steam for the first three will be generated in five cylindrical double boilers and two single boilers. They will be placed in two separate water-tight compartments and will be operated with natural draft. The Bremen will be equipped with Howden's system of forced draft. The steam pressure will be 213 lbs. per sq. in. During the coming fall and winter these four boats will be placed on the eastern service, from Bremen to Australia, but will next spring take their place in the service between Bremen and New York.

THE SCRAP HEAP.

Notes.

The conductors and enginemen who managed the special train of the Pennsylvania which carried Li Hung Chang from Washington to Niagara Falls have received silver medals from the Viceroy.

The Galveston, La Porte & Houston Railroad, having had much annoyance from claims for animals killed on the track, has made its enginemen sign individual contracts to pay one-half the amount of damages for stock killed by their engines.

On the West Shore road south of Kingston, N. Y., one night last week a man riding in a car with horses was beaten and robbed of $100 by thieves who entered the car from the roof while the train was in motion. Another man in another car was also beaten. The robbers escaped.

A passenger train of the Atlantic & Pacific was stopped by robbers about 30 miles west of Albuquerque on the night of Oct. 2, but they did not succeed in getting any booty. Dynamite was used to break open the express car. One of the robbers, said to be the leader, was killed by a Deputy United States Marshal who happened to be on the train.

The Pennsylvania Railroad has nearly completed, at Powelton avenue and Thirty-second street, West Philadelphia, a building for the offices of the Division Superintendents located at that point, who were burned out several months ago when the old passenger station was destroyed. The new building is 50 ft. × 114 ft. and three stories high.

On Sept. 27 Mr. W. L. Wilson, Paymaster of the Longdale Iron Co., West Virginia, riding on the engine of a passenger train, was stopped near Sewall by a highwayman and robbed of $2,800, the engineman and the fireman being intimidated. The robber had two revolvers. After getting hold of the money he dropped one of them and ran; Wilson grabbed the revolver and opened fire, but the robber turned round and shot Wilson fatally.

On Thursday of last week a number of commission merchants in New York City, said to be 30 or 40, were cheated out of $12.74 each by counterfeit freight bills presented by a respectable-looking man who seemed to be an agent of the Delaware, Lackawanna & Western Railroad. He went from one office to another presenting at each an announcement of the arrival of 26 barrels of apples consigned to the firm, and presented a regularly made out freight bill. Some of the firms paid in checks and succeeded in stopping payment at the banks. Thirty or 40 truckmen appeared at the freighthouse all about the same time, each calling for 26 barrels of apples.

New York State Canal Improvements.

A statement of the work to be done, under the $9,000,000 appropriation, on the New York State Canals, has been given by Deputy State Engineer Roberts. The existing canals are to be deepened only, and not otherwise improved. The work will necessitate a large

amount of excavation, and building and rebuilding of vertical and slope pavement walls.

On the eastern division of the Erie Canal, work will be done over a distance of 34½ miles, between locks Nos. 18 and 45. On the middle division the work will be as follows: From the east line of Oneida County to lock 46, 3.33 miles; from lock 49 to lock 50, 4.94 miles; from lock 50 to Camillus Feeder Bridge, 3.92 miles; from Camillus Feeder Bridge to Peru Road Bridge, 6.31 miles; from Peru Road Bridge to lock 51, 4.68 miles; also locks 46, 49 and 50 are to be lowered. On the western division work will be done: Between Ferry street and Commercial Slip, Buffalo, 3.45 miles; between McDonald's Culvert and Ferry street, Buffalo, 18.35 miles; between McDonald's Culvert and the Lockport locks, 5.83 miles. The Carterville waste weir will be rebuilt.

The work on the Champlain Canal will be from Waterford Sidecut to lock 5, 1.3 miles; from lock 6 to lock 7, 3 miles; from Ft. Edward to Ft. Ann, 11.75 miles.

The following dams in the Oswego Canal will be improved: Phœnix, Braddocks, Minetto, High and Oswego Lock No. 18, at Oswego, will also be lowered and lengthened.

This work has all been approved by the State Canal Board, and is now practically ready for advertising. This will probably be done by Superintendent of Public Works Aldridge, in lots of five or six, so that the bids may be more easily handled by the department. The rest of the plans and estimates for all work to be done on the Erie, Oswego and Champlain Canals are nearly ready, and contracts can probably be awarded during the coming winter, though practically no work can be done on these latter contracts until the close of navigation in 1897, as the work is so light that it probably would not be advisable to do any of it by dredging.

Horseless Carriages.

The international race of horseless carriages from Paris to Marseilles, France, and back, open to all comers, irrespective of character of artificial power used, was won Oct. 3 by carriages propelled by Daimler motors, which covered the distance of 1,100 miles in 72 hours, or at the average rate of 15¼ miles an hour. Thirty-eight carriages started, only two being propelled by steam—all others by petroleum. Of these, only 11 returned in the time limit; the three first being Daimler motors. The Daimler Motor Co. is exhibiting its motor at the American Institute Fair which is being held at New York during the month of October.

Prince Hilkoff.

A few weeks ago we described in some detail the journey projected by Prince Hilkoff, the Russian Minister of Ways of Communication, across the United States for the purpose of examining our railroad system in considerable detail. A recent press dispatch states that the plan for making a study of our railroads and of our manufactures of railroad material has been abandoned by the Prince, and that he will make but a very brief stay in the United States. Those who are in a position to know something of the circumstances say that it is highly probable that this is true, and that the contemplated studies of our railroad systems and facilities will be abandoned.

The Cape Cod Canal Again.

The Massachusetts Railroad Commissioners and the Board of Harbor and Land Commissioners, in joint session, have authorized the issue of $6,000,000 stock and a like amount in bonds of the Maritime Canal Co., a corporation formed to carry out the project of constructing and operating a ship canal through Cape Cod. The capitalization had been previously fixed by the General Court, but the approval of the Commissioners was needed to make it valid. No plans for the issue have yet been made public.

Heavy Trains.

The through mail business over the Pennsylvania lines, says the Pittsburgh *Post*, is now at its height, and all trains that carry mail are hauling extra cars. The through limited mail on the Panhandle is now hauling seven and eight solid cars of through mail for Western points, and the eastbound is running very heavy. The latter train, first No. 6, on Thursday had 11 cars, six of them loaded with mail. The amount of mail handled on the Panhandle is prodigious. No. 11 carries eight cars, No. 5 has from five to seven cars, No. 3 one car, No. 6 five cars, No. 8 three cars, No. 10 one car, making about 25 cars of through mail daily. On the Ft. Wayne the limited express, No. 5, and its counterpart, No. 2, carry from two to four mail cars, No. 7 carries five cars, and Nos. 8, 4, 6 and 9 and several local trains have mail cars attached. The present heavy rush of mail is said to be due to some extent to the many letters of the political parties. The earnings of the Pennsylvania from mails in 1893 were:

Pennsylvania	$1,356,137
P., C., C. & St. L.	774,475
Penn. Co. lines	436,216
Total	$2,569,828

The Pittsburgh reporter is very proud of the railroad glories of his town, and, in another item, spreads out in this way: Train No. 20, from St. Louis, is the greatest train in the country. Yesterday morning it was immense, being made up of six vestibuled coaches and six Pullmans, and although hauled by one engine it arrived on time, having made the fast run across six states on schedule time. Class P. engine No. 37, run alternately by Conboy and Buchanon, hauls the train regularly.

A "Tug-of-War."

A tug-of-war between locomotives is a thing which is not often undertaken, except for fun, the last one that we recollect being that between a steam engine and an electric motor at Chicago in 1893, in which case the contest was put up, we believe, at the instance of people who fondly believe that electricity is an original source of power, and who, therefore, thought they were promoting the spread of scientific information. But at Burlington, Vt., the other day, there was an actual quarrel which took this shape. The Rutland Railroad has lately been taken out of the hands of the Central Vermont. The latter road, in pursuance of its arrangements for securing its rights, started to haul off two carloads of machinery from the Rutland road repair shop about four o'clock in the morning, but the Rutland people discovered the alleged unlawful abstraction just in time to couple an engine to the rear end of the two-car train on which the machinery was loaded. The Central Vermont employees had got the loaded cars on to their track, north of College street, when a Rutland engine was attached to the rear end of the train and a regular tug-of war ensued. The Rutland engine was the heavier and the train, Central Vermont engine and all, were slowly but surely being hauled toward Rutland, when a Central Vermont employee thought of a trick that saved the day, or rather night, and secured the train for his company. The Central Vermont engine was suddenly reversed sending the cars against the Rutland engine and making it possible to pull the pin which coupled the train to the Rutland engine. The train then started for St. Albans and when asked where the machinery at present was a Central Vermont official replied that it was "up the line."

Manchester Ship Canal.

The report for the last half-hear shows that the gross receipts of the Manchester Ship Canal amounted to £81,214, and the expenses to £88,643, leaving a debit balance of £7,429. The Bridgwater undertaking yielded a net balance of £22,566; so that, taking the whole concern as it stands, the working of the past half-year left but a credit balance of £15,137 to meet the interest on an outlay to date of £15,154,203. The Bridgwater undertaking is the only valuable asset left, and the more the canal business is pushed the more the Bridgwater receipts suffer. In the original estimate it was assumed that the profits of the Bridgwater undertaking would cover the debenture interest of the Ship Canal Company. The six months' interest on the first and second debentures, excluding the corporation loan, amounted to £44,742; while the net revenue of the Bridgwater undertaking only came to £22,566, or about one-half. In the June half of 1891 the Bridgwater net receipts amounted to £30,355, and they have been dwindling year by year since then, the net receipts of the past half year being £6,000 under those of the corresponding six months of last year. Another point which makes us think the situation is worse than is imagined is the nature of the working expenses. During the past six months, as we have seen, there was a loss in working the ship canal of £7,429. Revenue for the first time bore the brunt of expenses. But did it bear the full brunt? We can well understand the anxiety of the directors not to make things look too bad. One of their own experts some time back put the cost of dredging alone at £80,000 per annum, while for the past half-year the cost of dredging and "other maintenance" is charged at £36,701. What the "other maintenance" consisted of is not stated, but the inference is that the full cost of keeping up the works will become heavier as time goes on. Then, as regards capital, the position is most serious. The balance of unexpended capital is put at £182,342, but as £152,254 is locked up in stores, the cash balance is somewhere about £30,000, not enough, we should say, to meet current liabilities. So far the first and second debenture interest has been met, but interest on the Corporation loan to the amount of £281,250 remains unpaid. As this far exceeds the balance of capital, it will be seen that the Canal Company is at the end of its tether in every respect. The prospect for the first and second debenture holders and for the ratepayers of Manchester is most serious. The true fact is becoming clear to the most enthusiastic that next to Panama the Manchester Ship Canal is the greatest commercial blunder of the century.—*Herapath's Journal.*

The Franklin Institute.

The programme of weekly lectures of the Franklin Institute for 1896–7 is received. The first one announced is by Professor Houston on "X-Rays" for Oct. 30. One which should be of considerable interest to our readers will be by Mr. F. A. Fitzgerald on the "Manufacture and Development of Carborundum at Niagara Falls" for Dec. 11. Another, to be delivered on Jan. 4, is "Electricity in Warfare," by Lieut. B. A. Fiske, and on Jan. 8, Mr. H. H. Suplee will give an illustrated lecture on "Locks and Fastenings of Security," which will doubtless be an interesting and valuable study. Jan. 22, Dr. C. B. Dudley, of the Pennsylvania Railroad, will give a lecture on "The Ventilation of Passenger Cars for Railroads," surely a matter of great importance. On March 12 Professor Jacobus will lecture on "Artificial Lights," comparing modern methods. March 26 Mr. A. E. Hunt will lecture on "The Development of the Use of Aluminum in the Arts."

The Russians in Manchuria.

A press dispatch from Pekin states that consent has been given by the Chinese government for the building of a branch of the Siberian Railroad across Northern Manchuria, with a pre-emption clause giving China the right of purchasing this branch after 30 years. Permission to construct a branch through Southern Manchuria was refused.

The Hollerith Tabulating Machine.

The New York Central & Hudson River road has contracted with Dr. Herman Hollerith, of Washington, D. C., for a number of his electric tabulating machines for use in the office of the Auditor of Freight Accounts, New York City. Enough machines will be put in to keep the whole of the freight records in the general office of the company, and work will be begun on Jan. 1, 1897. One machine has been in use on the freight accounts for several months for the purpose of familiarizing the clerks with its manner of operation. This ingenious device, first made for use in counting and assorting the facts gathered in the census office at Washington, was described in the *Railroad Gazette* of April 19, 1895. Records are kept by means of punched cards instead of by the use of pen and ink; and the holes in these cards, controlling electric circuit closers, act as automatic sorters, so that the classification of figures is accomplished without mental effort. Adding is also done by machinery, and there is a perfect arrangement for detecting errors.

Locomotive Boiler Explosion at Peterton, Kan.

The explosion of the locomotive of a passenger train of the Atchison, Topeka & Santa Fe, near Peterton, Kan., on Oct. 4 was unusually disastrous, 6 persons being killed and the first four cars of the train wrecked. Only only one passenger was injured. The accounts state that there were two explosions, one after another, and the size of the hole in the ground beneath the engine is so large that it has been conjectured that the explosion was caused by dynamite. The barrel of the boiler did not explode, but the firebox was blown entirely out of the frame. The only employees killed were the engineman and fireman, the other four persons killed being tramps who were riding on the baggage car. One passenger, supposed to have been intoxicated, killed himself with a pistol after the explosion. He had been greatly agitated by the excitement, but at the time he shot himself he was sitting quietly in his seat in one of the cars. The train was running rapidly at the time, and the tramps were killed by the crushing of the cars after their derailment, not by the explosion.

The Cape Cod Canal.

The Maritime Canal Company, owner of the franchise for a ship canal across Cape Cod, from Buzzard's Bay to Cape Cod Bay, has been authorized by the Massachusetts Railroad Commissioners and Harbor and Land Commissioners, sitting jointly, to issue $6,000,000 of stock and the same amount of 50-year 5-per cent. bonds. This action is in accordance with a law passed by the last legislature.

BRIDGE BUILDING.

Baltimore, Md.—A resolution has been passed granting permission to the Lake Roland Elevated Railroad to build a double-track iron bridge across the Windsor Mill road.

Bangor, Me.—It is reported that the Civil Engineers of the Boston & Maine are drawing plans for a new steel bridge across the Piscataquis River.

Burlington, Vt.—It is stated that it has been voted to build a new 155-ft. steel bridge across the river at a cost of not over $4,000.

Canton, O.—Engineer Chapin has been instructed by City Councils to proceed with the construction of a bridge across Shriver's Run on Odd Row.

Cincinnati, O.—Bids for the proposed new steel aqueduct, which is to carry the canal over Mitchell avenue, were received, Sept. 25, as follows: Brackett Bridge Co., Cincinnati, $59,999; Champion Bridge Co., Wilmington, O., $78,000; Cincinnati Architectural Iron Co., $60,100 and $62,500; Cincinnati Bridge Co., $60,000; Groton (N. Y.) Bridge and Mfg. Co., $68,000; Indiana Bridge Co., Muncie, Ind., $71,000; King Bridge Co., Cleveland, O., $50,800 to $61,200; Lafayette Bridge Co., Lafayette, Ind., $30,000; Massillon (O.) Bridge Co., $62,500 and $68,200; Milwaukee (Wis.) Bridge Co., $67,500; Oregonia (O.) Bridge Co., $69,000; Penn Bridge Co., Beaver Falls, Pa., $66,000; Toledo (O.) Bridge Co., $65,000; R. D. Wheaton Bridge Co., Chicago, Ill., $65,000; Youngstown (O.) Bridge Co., $63,250.

Clearwater, Man.—Mr. W. Cranston, clerk of the municipality of Louise, is receiving tenders for repairs and extension of the traffic bridge and approaches at this place. Plans and specifications can be seen at the Department of Public Works at Winnipeg.

Howick, Que.—Mr. D. R. Hay is receiving tenders for rebuilding the bridge at Riverfield, in the parish of Tres St. Sacrement. The bridge is 125 ft. long, 16 ft. wide, parties tendering to furnish their own plans.

Ironton, O.—Officials have inspected the site for the proposed new bridge across the Ohio River, between this place and Ashland, Ky. The Board will not be ready to report for some time. It is reported that there are some differences of opinion between the bridge people and the representatives of the government as to the height and position of the bridge.

Lowell, Mass.—It has been voted to rebuild Wilder street bridge at a cost, it is said, of $4,000. George Bowers, City Engineer.

Media, Pa.—A petition for a new bridge over Lobb's Run, in Alden, has been laid before the Grand Jury.

Morristown, N. J.—The Wrought Iron Bridge Co., Canton, O., has been given the contract for a bridge over the Whippany River, at Abbott avenue, for $1,567.

Newark, N. J.—It is reported that bids for the steel work of the Newark approach to the new bridge over the Passaic were received Sept. 30, as follows: Boston (Mass.) Bridge Co., $26,900; N. T. Connelly, Jersey City, N. J., $26,606; Edge Moor Bridge Co., Wilmington, Del., $26,750; Fagin Iron Works, Hoboken, N. J., $21,612; Millard & Lahey, $27,000; F. C. O'Reilly, Jersey City, $29,876; Youngstown (O.) Bridge Co., $28,800.

Philadelphia, Pa.—Ordinances have been introduced in the City Council appropriating $60,000 for a bridge over the Connecting Railroad at Lehigh avenue; appropriating $40,000 for a bridge under the Connecting Railroad on the line of Dauphin street: appropriating $70,000 for the construction of a bridge over the Philadelphia, Germantown & Norristown on the line of Seventeenth street.

Providence, R. I.—Plans have been prepared by the City Engineer for a new bridge over the Woonasquatucket River at Manton avenue, Olneyville Square.

Quebec, Que.—A deputation from this city recently had an interview with the Dominion Government authorities regarding the building of a bridge across the St. Lawrence River opposite this place. The city has offered to subscribe $500,000 toward the bridge.

RAILROAD LAW—NOTES OF DECISIONS.

Carriage of Goods and Injuries to Property.

In Minnesota a carrier received goods to be carried to a point beyond its own line, with directions to deliver them to certain connecting carriers, with the last of which the shipper had made an agreement for stopping the car at intermediate points on its line for delivery of portions of the goods. It, however, wrongfully sent the goods by different connecting carriers, whose lines reached but one of the intermediate points. On arrival of the goods there, the shipper disclosed his contract to have them distributed at the three points, and demanded compliance therewith. The carrier refused compliance until payment of freight for the whole route, when it delivered the goods destined to that point, and undertook, at its own cost, to carry to each of the other points the portion of the goods to be delivered there, and in doing so the goods were injured. The Supreme Court holds that the initial carrier, though it did not know of the shipper's agreement with the last connecting carrier to which it was directed to deliver the goods, was liable for the damage.[1]

In Tennessee a shipper consigned potatoes to defendant railroad, with directions to deliver them at E. to a particular connecting line, but, on their arrival at E., such line refused to receive them, owing to a strike on its road, and defendant, without communicating with the shipper, delivered the potatoes to another line, as expeditious as the one selected by the shipper. The strike having spread, the potatoes were stopped in transit over the substituted line, taken back to one of its stations, and sold, no notice of this fact being given to the shipper until several days after the shipment, when he refused to accept the proceeds. The Supreme Court rules that defendant was liable for the loss resulting from the deviation from the selected route, the freight not being of such perishable nature as to necessitate its immediate trans-shipment at E. without notice to the shipper.[2]

In Texas a railroad company received and issued bills of lading making it liable for loss by fire, in case of negligence, for uncompressed cotton, and under authority of the assignee of the bills, sent it to a compress company, and, after it was compressed, allowed it to remain for an unreasonable length of time on the platform of the compress company, exposed to sparks from passing engines, and it was burned up. The Supreme Court holds that the company was liable for the cotton.[3]

In Texas one was in the habit of walking on the track through the yards, and knew the position of the switches and the condition of the tracks, was run over and killed by a train while so walking in the evening, by reason of having his foot caught in a switch. The Supreme Court

rules that the circumstances implied contributory negligence.[4]

The Supreme Court of Missouri holds that the fact that the engineer might have seen a trespasser on the track when one-eighth of a mile from him, and gave no warning till within 100 ft., is not negligence, if such warning was given in time for the trespasser to have safely left the track.[5]

Injuries to Passengers, Employees and Strangers.

In Ohio it is held that where a railroad conductor refused to accept a mileage book from a passenger to whom it was issued and in a rude and ungentlemanly manner, and with insulting language, in a car full of ladies and gentlemen, takes hold of the coat collar of such passenger and drags him into the aisle, and only desists from ejecting him because he pays his fare in cash, the company is liable for punitive damages, though no physical injury is inflicted on the passenger.[6]

In Nebraska it is held that a shipper of cattle, who, for the purpose of enabling him to care for his stock in transit, receives a drover's pass, is not, while accompanying his stock, entitled to all the rights and privileges of an ordinary passenger for hire.[7]

In Texas plaintiff purchased a ticket on Nov. 10 from L. to W. and return, good for one day only, but which provided that the holder might have the same extended by depositing it with the agent at W. before its expiration. This plaintiff failed to do, and on Nov. 30 presented the return half of the ticket, which the conductor had refused to accept, to the company's agent at L., and demanded one-half the amount which he had paid for the round-trip ticket, but was refused. The Supreme Court rules that plaintiff was not entitled to recover the penalty provided by the statute, for the refusal of a railroad company to redeem unused tickets, or parts thereof, if presented within 10 days after the right to use the same has expired by limitation, plaintiff's right having expired on Nov. 11.[8]

In Georgia it is held that where a system of railways, though owned by one company or operated under one management, is divided into separate divisions, a ticket having attached to it a coupon for each of such divisions entitles the holder thereof to break his journey, and stop over at the end of each division, and resume it again upon the next coupon, provided this be done within the final limit fixed by the ticket, and there be no specific contract upon the ticket to the contrary.[9]

In Kentucky it is said that one of two passengers, who were acquaintances and had been drinking together, and who entered the train together, cannot recover damages from the carrier for abusive languge used toward him by the other, who was intoxicated, or even for an assault, where the conductor used all reasonable efforts to protect him, quieted the offender one or twice, and, on his again becoming boisterous, gave him into custody at the next station.[10]

The Supreme Court of Georgia holds that where a passenger put out his hand to prevent from shutting a car door which the porter had just slammed, without knowledge that the passenger was following him, and the passenger's thumb was caught and crushed by the door, the company was not liable.[11]

In Texas a provision on a railroad ticket that it shall be good for one day only, unless the holder shall deposit the return half thereof with the company's agent before expiration, and have it extended, is reasonable.[12]

In Georgia in the absence of terms rendering a railroad ticket non-assignable, it passes by delivery.[13]

In Virginia, defendant's train having slowed down, failed to stop at a station where plaintiff wished to alight, and plaintiff, encumbered with bundles, went out of the car in search of the conductor, and having reached the platform, was thrown off the train, by reason of its suddenly accelerated speed while passing around a curve. The court rules that while it was negligence to fail to stop at the station, said negligence was not the proximate cause of the accident.[14]

In Pennsylvania, there being on defendant's main track a coal train about to move, deceased stopped on a side track, at the end of two freight cars, until the coal train moved out, when he immediately stepped out on the main track and was struck by a train about 60 ft. behind the coal train. There was evidence that the locomotive gave no warning, and it appeared that the space between the side and main tracks was only sufficient to allow the safe passing of trains. The Supreme Court rules that the question of contributory negligence on the part of the deceased was for the jury.[15]

The Supreme Court of Texas decides that where a pregnant woman fell by reason of a hole in the floor in defendant's station, it was not negligence on her part to fail to send for a physician at the time, the injury not creating an apprehension of immediate danger to her life or health.[16]

In Kentucky plaintiff was injured while on a hand car along with and by leave of a station agent who was employed by a road forming a junction with defendant road, and who performed certain duties for defendant, but the value of whose services to defendant was paid to the other road. Defendant's officers had forbidden such agent to use a hand car on their tracks, but it was shown that he had frequently used one, with plaintiff as a helper, in carrying passengers, and that the money received from passengers was not paid to defendant. The Supreme Court rules that plaintiff was not an employee of defendant, but merely a trespasser.[17]

In California it is contributory negligence per se to ride on a bicycle between the tracks of an electric street railway without watching for the approach of cars from behind.[18]

[1] Brown v. Pennsylvania Co., 65 N. W. Rep., 961.
[2] L. & N. v. Odill, 33 S. W. Rep., 611.
[3] M., K. & T. v. McFadden, 33 S. W. Rep., 853.
[4] Int. & G. N. v. Lee, 34 S. W. Rep., 160.
[5] Sinclair v. C., B. & K. C., 34 S. W. Rep., 76.
[6] P., C., C. & St. L. v. Ensign, 10 Ohio Cir. Ct. R., 21.
[7] Omaha & R. V. v. Crow, 66 N. W. Rep., 21.
[8] M., K. & T. of Texas v. Murphy, 35 S. W. Rep., 66.
[9] Spencer vs. Lovejoy, 23 S. E. Rep., 836.
[10] Kinney v. L. & N., 34 S. W. Rep., 1066.
[11] Ham v. Georgia R. & B. Co., 24 S. E. Rep., 152.
[12] M., K. & T. v. Murphy, 35 S. W. Rep., 66.
[13] Spencer v. Lovejoy, 23 S. E. Rep., 836.
[14] Jammison v C. & O., 23 S. E. Rep., 758.
[15] Gray v. Penn., 33 Atl. Rep., 697.
[16] T. & P. v. Neal 33 S. W. Rep., 693.
[17] East, Kentucky vs. Powell, 33 S. W. Rep., 629.
[18] Everett v. Los Angeles Consol. E. R., 43 P., 207.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Central of New Jersey, 1¼ per cent., payable Oct. 15.
Cincinnati, Hamilton & Dayton, quarterly, 1 per cent., payable Oct. 6.
Cleveland, Lorain & Wheeling, 1 per cent. on preferred stock, payable Oct. 21.
Dayton & Michigan, 1¾ per cent. guaranteed on common stock, payable Oct. 1, and 2 per cent. guaranteed on the preferred stock, payable Oct. 6.
Vermont & Massachusetts, quarterly, 3 per cent., payable Oct. 7.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Alabama & Vicksburg, annual, Jackson, Miss. Nov. 2.
Baltimore & Cumberland Valley, Baltimore Oct. 21.
Bangor & Aroostook, annual, Bangor, Me., Oct. 20.
Boston & Maine, annual, Lawrence, Mass., Oct. 14.
Chesapeake & Ohio, Richmond, Va., Oct. 20.
Cleveland, Cincinnati, Chicago & St. Louis, annual, Cincinnati, O., Oct. 28.
Concord & Montreal, annual, White's Opera House, Concord, N. H., Oct. 13.
Danbury & Norwalk, annual, Consolidated Railroad Company's building, New Haven, Oct. 29.
Erie, annual, 26 Cortlandt street, New York, Oct. 13.
Illinois Central, annual, Chicago, Ill., Oct 14.
Maine Central, annual, Portland, Me., Oct. 21.
Minneapolis & St. Louis, annual, Minneapolis, Minn., Oct. 6.
New Orleans & Northeastern, annual, New Orleans Nov. 4.
Northern Pacific, annual, New York, N. Y., Oct. 15.
Peoria, Decatur & Evansville, annual, Pekin, Ill., Oct. 6.
Pittsburgh & Western, annual, Allegheny City, Pa., Oct. 19.
Rio Grande Western, annual, Salt Lake City, Utah, Oct. 25.
St. Louis, Alton & Terre Haute, annual, St. Louis, Mo., Oct. 21.
St. Louis & San Francisco, annual, St. Louis, Mo., Oct. 27.
St. Paul & Duluth, annual, St. Paul, Minn., Oct. 13.
Southern, annual, Richmond, Va., Oct. 20.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Street Railway Association* will hold its annual convention at St. Louis on Oct. 24 and 25 For programme see issue of Sept. 18, page 660.

The *Engineers' Club of Philadelphia* will hold its next business meeting on Oct. 30.

The *Association of Railway Superintendents of Bridges and Buildings* will hold its annual meeting at Chicago on Oct. 20. For programme see issue of Aug. 7, page 560.

The *Society of Naval Architects and Marine Engineers* will hold its third general meeting at No. 12 West Thirty-first street, New York City, on Nov. 12-13.

The *Railway Signalling Club* will meet on the second Tuesday of the months of January, March, May, September and November, in Chicago.

The *Western Railway Club* meets in Chicago on the third Tuesday of each month, at 2 p m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m., except in June, July and August.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Tuesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the second Friday of January, March May, September and November, at 2 p. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets in its rooms on the first Wednesday of each month, at 8 p. m. to hear reports, and for the reading and discussion of papers. The headquarters of the Society are at 1736–739 Monadnock Block, Chicago.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m., except during July and August.

The *Denver Society of Civil Engineers* meets at 3 Jacobson Block, Denver, Col., on the second Tuesday of each month except during July and August.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month, at 7.30 p. m. Address P. O. Box 333.

The *Engineers' and Architects' Club of Louisville* meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday each month at 8 p. m.

The *Western Foundrymen's Association* meets in the Great Northern Hotel, Chicago, on the third Wednesday of each month. S. T. Johnston, Monadnock Block, Chicago, is secretary.

The *Engineers' Club of Columbus, (O.)*, meets at 12½ North High street, on the first and third Saturdays from September to June.

The *Engineers' and Architects' Association of Southern California* meets each third Wednesday of the month in the Hall of the Chamber of Commerce, Los Angeles, Cal.

The *Engineers' Society of Western New York* holds regular meetings the first Monday in each month, except in the months of July and August, at the Buffalo Library Building.

The *Civil Engineers' Society of St. Paul* meets on the first Monday of each month, except June, July, August and September.

The *Engineers' Society of Western New York* meets on the first Monday of each month at the Society's rooms in the Buffalo Library.

The *Boston Society of Civil Engineers* meets at 715 Tremont Temple, Boston, on the third Wednesday in each month, at 7:30 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Engineers' Society of Western Pennsylvania* meets at 410 Penn avenue, Pittsburgh, Pa., on the third Tuesday in each month, at 7:30 p. m.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds informal meetings on the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at 8 p. m.

Traveling Passenger Agents' Association.

This association held its annual convention at St. Louis last week. F. H. Tristam, Agent of the Wabash at Pittsburgh, Pa., was elected President. Captain Frank D. May, formerly of the Pennsylvania, and now 84 years old, was present at the convention, and was presented with a cane. Captain May first became a passenger agent in 1853.

PERSONAL.

—Mr. George W. Parker, President of the St. Louis, Alton & Terre Haute, has returned from an eight months' absence in Europe.

—Mr. A. M. Parker, Assistant Supervisor of the Pennsylvania, at Lancaster, Pa., has been transferred to Philadelphia, the change taking effect Oct. 1.

—Mr. H. M. Pierce, Assistant General Freight Agent of the Chicago, St. Paul, Minneapolis & Omaha, has been made General Freight Agent of the road, to succeed J. T. Clark, who has been appointed General Traffic Manager.

—Mr. John H. Winder, who for several years, and up to about six months ago, was the General Manager of the Seaboard Air Line, has formed a connection with the banking house of Sharp & Bryan, of New York City, and will remove with his family from Raleigh to New York at once.

—Mr. F. P. Eyman, City Freight Agent of the Chicago & Northwestern, at Milwaukee, and President of the National Association of Local Freight Agents, has been promoted to be General Agent of the Chicago & North-Western in Chicago. Mr. George D. Vilas succeeds Mr. Eyman at Milwaukee.

—Mr. D. I. Roberts, General Passenger Agent of the Erie Railroad, is lying very ill at his home in Montclair, N. J., suffering from an attack of appendicitis. An operation was performed about 10 days ago, and the chances are very much in favor of his recovery, although his escape has been a narrow one, and it cannot be said positively that he is yet out of danger.

—Mr. Alex. Galloway has been appointed Superintendent of the Cincinnati Division of the Cincinnati, Hamilton & Dayton, to succeed F. A. Husted, who has gone to the Baltimore & Ohio. In addition to having charge of the Cincinnati Division, Mr. Galloway will continue as Superintendent of the Indianapolis Division. He will have 160 miles of road under his jurisdiction.

—Colonel William N. Thompson, Treasurer of the Florida, Central & Peninsular, died at his home in Fernandina, Sept. 30, at the age of 54. Death was due to an accidental pistol shot received about four months ago. Colonel Thompson began railroad service with the Florida Railroad in 1869, and held various positions in the Treasurer's department until 1888, when he was promoted to the office which he held at the time of his death.

—At the fiftieth anniversary of the German Railroad Union a great many decorations were conferred by the German and Austrian Emperors and other German princes on various railroad men, few of them forgetting Mr. Kranold, the President of one of the Prussian State Railroad Directories, who has been President of the Union for some years. We are pleased to see that Dr. Wilhelm Koch, the chief editor of the semi-weekly *Journal* of the German Railroad Union, and doubtless the Nestor of railroad journalists was not forgotten. Not only the German Railroad Union, but students of railroad affairs in all countries owe a debt of gratitude to this conscientious and intelligent editor.

—Mr. Robert L. Harris, M. Am. Soc. C. E. of New York City, died from the effects of an apoplectic stroke, in Kearsarge Village, N. H., on Sept. 29, at the age of 62. Mr. Harris was apparently in excellent health until stricken a few days ago. He was an old and prominent member of the American Society, and was also a member of the Institution of Civil Engineers of Great Britain. His career as an engineer was long and successful. His railroad experience began as Chief Draftsman of the Cleveland & St. Louis Air Line. From 1860 to 1871 he was in California, and was engaged professionally on most of the railroads projected and built in that state during that time. In 1871-2 he was Chief Engineer of the Northwestern Construction Company, which built the Northern Pacific across Minnesota. From 1872 to 1874 he was the Chief Engineer of the Chicago & Canada Southern, and subsequently he was Chief Engineer of the Canada Central Extension. In 1880 and 1882 Mr. Harris, in partnership with John Ross, built 234 miles of the International & Great Northern. On the completion of that work he practically retired from active business, but maintained an office in New York as consulting engineer. He was, however, in 1893, Chief Engineer for the Wilkesbarre and Hudson River Improvement Company, which built the Wilkesbarre & Eastern. He had worked in every state and every territory, except Alaska, also in Mexico, Cuba and Central America. Mr. Harris ranked high in his profession and was a man of high character and integrity. A widow and two daughters survive him.

ELECTIONS AND APPOINTMENTS.

Chicago & Northwestern.—Hiram R. McCullough, formerly General Freight Agent, has been appointed General Traffic Manager, with office at Chicago This is a new office, lately created. Marvin Hughitt, Jr., formerly Assistant General Freight Agent, has been appointed General Freight Agent, with office at Chicago.

Chicago, Burlington & Northern.—George P. Lyman, heretofore Chief Clerk in the freight department, has been appointed General Passenger Agent. Mr. W. J. C. Kenyon, heretofore General Freight and Passenger Agent, will devote himself entirely to the freight department.

Cleveland, Cincinnati, Chicago & St. Louis,—Thomas J. English has been appointed Superintendent of the

Cincinnati and Sandusky divisions with headquarters at Springfield, O., to succeed William Gibson.

Cleveland, Lorain & Wheeling.—At the annual meeting of the stockholders in Cleveland, Oct. 6, the old Board of Directors was re-elected as follows: M. D. Woodford, Eugene Zimmerman, Cincinnati, O.; James A. Blair, Henry A. Taylor, Alfred Sully, H. F. Shoemaker, John B. Dennis, New York, N. Y.; W. R Woodford, W. A. Shoemaker, Dan P. Eells, Julius E. French, L. A. Russell, Cleveland, O.; J. Walter McClymonds, Massillon, O.

Columbus, Sandusky & Hocking.—The following Directors were elected, at Columbus, on Sept. 27: D. S. Gray, F. J. Picard, Geo. Sinks, Charles Parrott, Henry Stearns, C. D. Firestone, H. D. Turney, Theodore Leonard, W. E. Guerm and John P. McCune, Columbus; H. W. Putnam, J. F. Greenough, Charles F. Dean and C. G. J. Hall, of New York City, and E. H. Jurhorst, Sandusky.

Cumberland Valley.—These directors were re-elected at the annual meeting held in Harrisburg Oct. 5: President, Thomas B. Kennedy; directors, Thomas B. Kennedy, George B. Roberts, John Stewart, A. J. Cassatt, John P. Green, J. Herman Bosler, Edward B. Watts, M. C. Kennedy, Henry D. Welsh, Spencer C. Gilbert and John N. Hutchinson.

Fitchburg.—At the annual meeting, at Boston, on Sept. 30, Joseph B. Russell was elected a Director of the road, to succeed Wm. L. Chase. All of the other members of the Board were re-elected.

Great Northern.—Assistant General Superintendent Russell Harding, whose office is at Spokane, has had his territory extended and now has charge of the line eastward as far as Minot, N. Dak.

Lakeside & Marblehead.—At a stockholders' meeting, on Sept. 30, the directors whose terms had expired were re-elected. The present officers are: Norman Kelley, President; F. A. Beckwith, Vice-President; Caleb E. Gowen, General Manager; H. R. Moore, General Freight Agent; W. M. Marsh, Superintendent.

Louisville, Evansville & St. Louis.—J. F. Sechler, Master Mechanic at Princeton, Ind., has resigned, and will be succeeded by Frank C. Cleaver, late Master Mechanic of the Vandalia, at Terre Haute.

Oregon Railroad and Navigation Co.—The following is the Board of Directors of the reorganized company: E. McNeill, President; A. S. Heidelbach, Chairman of the Board; H. W. Corbett, Miles C. Moore, C. H. Lewis, H. Failing, W. M. Ladd, W. B. Ayer, W. W. Cotton, A. L. Mills, Charles S. Fairchild, Wm. L. Bull, J. Crosby Brown, F. S. Bangs and W. E. Glyn.

St. Louis Southwestern.—At the annual meeting of the stockholders in St. Louis, Oct. 6, the old Board of Directors was re-elected as follows: S. W. Fordyce, St. Louis; Edwin Gould, Dobbs Ferry, N. Y.; W. B. Doddridge, St. Louis; M. Gernsheim, R. M. Galloway, Thomas T. Eckert and Winslow S. Pierce, New York; Robert Moore and A. L. Wolff, St. Louis.

Seaboard & Roanoke.—At the annual meeting of this company, which controls the Seaboard Air Line, held in Portsmouth, Va., Oct. 6, the old Board of Directors was re-elected with the exception that B. B. Gordon was chosen to fill the vacancy caused by the death of Enoch Pratt, of Baltimore. R. C. Hoffman was re-elected President, the motion being made by Mr. John Gill, who had announced his purpose to oppose Mr. Hoffman's election in case he could secure the co-operation of a majority of the stock.

Seattle & International.—At the annual meeting of the stockholders at Seattle, Wash., Sept. 28, the following new directors were elected: Morton S. Paton, James D. Smith., Moore & Moffet, of New York, and General John H. Bryant and Judge H. C. Struve, of Seattle.

RAILROAD CONSTRUCTION

Incorporations, Surveys, Etc.

Butler & Pittsburgh.—Over 3,000 men are now employed on the line between Pittsburgh and Butler, Pa., and work is being pushed on rapidly. The last 14 miles at the Pittsburgh end are in the hands of two contractors, one of whom has 175,000 cu. yds. of earth to take out. At the Butler end one firm has 10 miles, with 200,000 cu. yds. of excavation. The whole line is a succession of deep cuts and fills, making the construction work very heavy.

Chattanooga & Augusta.—Preliminary surveys for this road have been begun by F. S. Wallace, Chief Engineer. The survey was begun at Chattanooga, Tenn., and the line runs nearly due south. It has now been completed below the Rossville "gap," in Northwestern Georgia. The road is proposed to connect Chattanooga with Augusta, Ga. A line is also proposed northward from Chattanooga in the direction of Evansville, Ind. The headquarters will be at Chattanooga.

Columbia & Red Mountain.—This road, which is an extension of the Spokane Falls & Northern, is being built from Northport, on the Columbia River, in Northeastern Washington, to Rossland, B. C., 15 miles. Seven miles of the road are in this country and cross the Colville Indian Reservation, in Washington. Track laying has been begun on the reservation and Engineer Van Houghton states that work will be pushed rapidly. Grading has been nearly finished on the reservation.

Florence & Cripple Creek.—Final surveys have been made for the branch line of this road, to be known as the Golden Circle extension, from Victor, Col., to Goldfield and Altman, about 12 miles. Grading has been begun at Victor, and the work will be pushed rapidly. This branch will give an outlet to Independence, Altman and all the mines at Bull Hill and vicinity. The grading is being done by J. B. Orman.

Great Northern.—Foley Bros. & Guthrie, contractors for the extension of this road from Halstad to Crookston, Minn., 33 miles, report that track has been laid on one-half of the line, and that work is progressing at the rate of two miles a day. An extension is also being built, on the Mayville Division, from Hope to Aneta, N. Dak., 26 miles. A cut-off has recently been completed on the same division, between Casselton and Fleming, N. Dak., and the track of the old line between Everest and Fleming has been taken up.

Gulf.—A charter was granted in Oklahoma, on Sept. 26, to a company formed to build this road, which is projected from Wakita, "L" County, Okla., in a general southerly direction through several counties of Oklahoma and Indian Territories, to Denison, in northern Texas. The incorporators are: G. S. Dill, John Grattan, R. L. Hall and L. B. Haven, of Medford, and John A. Blair, of Caldwell, Kan. The headquarters will be at Wakita, Okla.

Manitoulin & North Shore.—Mr. John MacIntyre, 56 Cluck Building, Niagara Falls, N. Y., is receiving bids for the construction and equipment of 42 miles of this road, extending from Little Current, Ont., to a point on the Soo branch of the Canadian Pacific.

Mexican Central.—The extension of the Guadalajara Division, from Guadalajara to Ameca, in the state of Jalisco, 55 miles, has been finished, and was opened to traffic last week. The territory between Ameca and the Pacific Coast has been carefully looked over by the management with a view to ultimately extending the road to the coast.

Mexican Roads.—The term for building the road from Vanegas to Cedral, Matehuala and Rio Verde has been extended in such manner that in each biennial period dating from Nov. 4, 1896, the company must complete at least 20 kilometers in addition to the 65 already built, and the whole line must be completed within seven years from the date mentioned. The subsidy is to be $4,000 per kilometer in bonds of the 5 per cent. interior redeemable debt, created by law of Sept. 6, 1894. The company takes the bonds at their full nominal value.

A charter has recently been obtained from the Mexican government, by Frederick Bartlett, of Chicago, authorizing a standard-gage road, 2,000 km. (1,242 miles), in length, to run from some point in the State of Chihuahua, on the Mexican Central road, westward to a point on the Sonora road, with branches running north into a rich mineral region and southward along the Pacific coast, thus making possible the development of the northwest and west coasts of the republic. The government has given a subvention on the main line, amounting to $13,600 per mile.

Mexico, Cuernavaca & Pacific.—Track has been laid from Tres Marias to a point about five miles beyond, or as far out as the grade is completed. Work is still being pushed on the grade and it is expected that within a short time the line will be completed to Cuernavaca. The grading on this section has been very difficult, on account of the rough nature of the country.

Montana.—Track-laying has been completed for 22 miles from Helena, Mont. The track-layers are nearing Box Canyon, where the work will proceed slowly. Once through the canyon, work will be pushed with all possible speed in the direction of Castle. About 250 men are in the employ of the company and contractors along the line. The contract calls for the completion of the work by Nov. 15.

New York & Brooklyn Railroad Co.—This is the title of a corporation which has filed a certificate with the county clerks in Brooklyn and New York, declaring an intention to bore a tunnel between the two cities beneath the East River, the New York terminus to be south of Canal street. The capital of the company is $20,000, and among the men named as directors is Hon. Alonzo B. Cornell.

Quakerstown & Easton.—It is the expectation of contractor Jamison to have this road completed between Quakerstown & Richlandtown by Dec. 25. Grading is being pushed rapidly, and is now completed to a point five miles north of Richlandtown. The road will pass through Richlandtown, Pleasant Valley and Springtown to Easton by way of Durham and will connect with the Poughkeepsie Bridge Railroad at Quakerstown, Pa.

St. Louis & San Francisco.—An extension is proposed, from Sapulpa, Ind. Ter., to Guthrie, Okla., passing through the Cimarron Valley. Surveyors are now in the field, locating the final line. The old Atlantic & Pacific right of way will be followed for part of the line. The preliminary survey shows that the construction work will be simple, there being no heavy grades encountered. The line will be about 75 miles long.

Southern Pacific.—Negotiations have been in progress between F. J. Capitan, representing this road, and a committee on the right-of-way, representing the people of Anaheim, California, for building a branch to connect Anaheim with the sugar factory at Alamitos. It is reported that satisfactory arrangements have been made, and construction work will begin shortly.

Tennessee, Georgia & Atlantic.—The final survey from Chattanooga, Tenn., has reached Washington, Ga., and a site for the station in Washington has been decided on. The proposed road will be 243 miles long, from Chattanooga, southeasterly across north Georgia, through Athens, to Augusta. Manager E. A. Richards states that grading will be begun before Oct. 15.

Washington, Annapolis & Chesapeake.—The survey has been completed as far as the Patuxent River. Preliminary surveys have been made in other sections, and an engineer corps of 15, under Chief Engineer L. H. Hyer, has gone as far as Davidsonville, in Anne Arundel County, Md. The road will pass through Woodmore, Prince George's County, instead of running over the Bay Ridge and Arundel-on-the-Bay route, as at first contemplated. The surveyors favor a direct line from Hill's Point, South River, to Annapolis, crossing South River.

Electric Railroad Construction.

Aurora, Ill.—The Aurora & Geneva Railway Co. was chartered July 29, 1896, with a capital stock of $10,000. On Aug. 12, a certificate was filed increasing the capital stock to $60,000. Among the directors for the first year are: R. B. Dodson, Wm. Fahnestock and J. Zeller.

Beaver Falls, Pa.—The River View Electric Railway Co., organized two years ago to build a line from Beaver Falls to Beaver via Patterson's Heights, but which did nothing further than secure a charter, subscriptions to stock, and rights of way, has again taken up the project, and the line may be built this fall.

Brunswick, Me.—One hundred men are at work on the new electric road to run from Brunswick to Topsham. A part of the Brunswick line is already laid, and the road will be built from Topsham through the town of Brunswick. In the spring the tracks may be laid through to Bath.

Bucyrus, O.—The County Commissioners have granted the franchise for an electric road between the Galion Corporation line and the Bucyrus Corporation line to Wm. E. Haycox, of Mansfield, and Fred. B. Perkins, of Toledo. A bond of $3,000 is required to be placed in the hands of the Commissioners on or before May 1, 1897, for the commencement of the work, the work must begin on or before the 1st day of June, 1897, and completed Aug. 1, 1898. The road will be about 18 miles in length, and the rate of fare (etc.) between Galion and Bucyrus is to be not more than 20 cents one way, nor more than 35 cents for the round trip, while the rate of fare to intermediate points is to be not more than 2 cents a mile.

Deering, Me.—The Portland Railroad Co. is erecting a line of new long poles on Forest avenue, intended to accommodate their wires and those of the electric-light company.

Connellsville, Pa.—The new electric line from Connellsville to Greater Connellsville, which was noted in our issue of Sept. 4, will be 2½ miles in length, single track, with overhead trolley and will be laid with 56-lb. rails. The contract for the equipment has been awarded to the United States Railway Equipment and Construction Co., of Cleveland, O.

Doylestown, Pa.—The Bucks County Railway Co. has leased the turnpike from Doylestown, in Bucks County, as referred to among our construction notes Aug. 7, and it went into effect Oct. 1. It is proposed to begin the construction of the road this fall and finish it by May, 1897. The company was chartered Aug. 3, 1894, but has done no construction work as yet. The capital stock is $10,000, and $3,300 was paid in up to May, 1896. Frank Booz, of Doylestown, can give further information.

Framington, Mass.—On Oct. 1, the Framington Union Street Railway Co. was granted permission to change the motive power of its Union avenue line from horse to electricity. It is stated that a company is being organized to build an electric road from Marlboro to connect with the Union street line in Framington, a distance of about seven miles.

Frederick, Md.—The Frederick & Middletown Electric Railroad has been opened through to the top of the hill at the east end of Middletown. Work on the extension to the fair grounds is rapidly progressing. Cars began to run over the road from Frederick to Braddocks Heights about Aug. 20, as mentioned among our notes, Aug. 28.

Greenbush, N. Y.—The Greenbush & Nassau Electric Railroad referred to Sept. 4 will begin at the eastern approach of the Albany and Greenbush bridge and run through Third avenue. Washington and Columbia streets in the village of Greenbush to the Rensselaer and Columbia turnpike, along which it will run for 4½ miles to Cotton's Corners, and thence across farming lands to Nassau, touching Lake Nassane on the route. John F. Lape, of Greenbush, can give further information.

Middletown, Conn.—The work of laying the tracks for the electric line between the Valley railroad crossing and the new bridge has just been completed. The cars will be running very soon.

New York.—The State Board of Railroad Commissioners has decided to grant permission to the Third Avenue Railroad to extend its system along the Kingsbridge road, and to use the overhead electric system. The extension will commence at 162d street, connecting with the present cable road, and will follow the Kingsbridge road to Spuyten Duyvil Creek.

Onondaga Lake, N. Y.—The Onondaga Lake Railroad Co. was given a hearing at Albany Sept. 28, on its application for permission to build its road from Syracuse to Onondaga Lake. An adjournment was taken until Oct. 19.

Peoria, Ill.—The Glen Oak & Prospect Heights Railway Co. has accepted the franchise granted by the City Council to build an electric road in Peoria, as noted in our issue of Sept. 25. The company is required to give a bond of $5,000 for the faithful performance of the requirements of the ordinance.

Redlands, Cal.—The *Pacific Electrician* states that A. H. Smiley has ordered a preliminary survey for the electric railroad to Fregolda Park. It is proposed to make it a mountain road, and Engineer McPherson, who built the Mt. Lowry Railroad, is at present making the survey. A portion of the power for this road is to be obtained from the canyon along the route and the remainder will be taken from the Redlands plant.

Santa Anna, Cal.—E. I. Tolle has been granted a franchise for an electric road on Main street, Santa Anna.

Santa Rosa, Cal.—The Board of Supervisors has granted a franchise to N. W. Grisword and others to build an electric railroad from Santa Rosa to Sonoma, via Malitta, Kenwood and Glen Cove, as referred to among our notes, Aug. 7.

Springfield, Mass.—A preliminary organization has been formed prior to the incorporation of the Springfield & Southwestern Street Railway Co., which proposes to build an electric road next spring from Main street in Springfield, through West Springfield to Agawan, and thence to Suffield. The capital stock will be $300,000. Among the temporary directors are: J. B. Conklin, of Catskill, N. Y., and W. H. Dexter, of Springfield.

Three Rivers, Que.—The North Shore Power Co. is being incorporated, with headquarters at Three Rivers, for the purpose of supplying electricity for light, heat and power to operate the electric roads.

Washington, D. C.—The Montgomery Construction Co. has been incorporated by George E. Teeple, N. Winslow Williams and others, with a proposed capital stock of $100,000. The company has been formed to build a line of electric railroad between Washington, D. C., and the suburban town of Tacoma, in Montgomery County, Md., for which a charter has been granted by Congress.

Ypsilanti, Mich.—Work has begun on the changing of the steam railroad between Ypsilanti and Ann Arbor to an electric system, noted in our issue of Aug. 28, the estimated cost being $25,000.

GENERAL RAILROAD NEWS.

Atchison, Topeka & Santa Fe.—The earnings for August have been reported as follows:

	1896.	1895.	Inc. or Dec.
Gross earn.....	$2,491,941	$2,374,892	I. $117,048
Oper. exp.....	1,769,088	1,973,136	D. 204,047
Net earn.....	$722,852	$401,756	I. $321,096
P. c. exp. to earn	71	83¾	

Carolina, Knoxville & Western.—Judge Townsend of the South Carolina courts, Seventh Judicial District, has issued a mandamus ordering the owner of this property, James K. Williams, to operate the road. The road, 14 miles long, was bought at sheriff's sale by Mr. Williams a few months ago, but, it appears, the business was not sufficient to pay operating expenses and trains were discontinued. Mr. Williams alleged that he was financially unable to run trains, and that no public obligation required him to do so, but the decision of the judge holds that the paramount duty to the public cannot be thus evaded. The order states that the owner

must forthwith operate the road from Greenville to all stations, and to continue trains the same as they were before the sale.

Cincinnati, Union City & Chicago.—The sale of this road, which was partly built two years ago, between Union City and Huntington, has been ordered at Wabash, Ind., for Oct. 31. There are several claims for labor and material against the road, one for $28,000 having just passed into the hands of John Bliss and F. W. Short, of Chicago. These gentlemen are endeavoring to reorganize the company and proceed with the work, and to this end have obtained judgment and a decree of sale on their mortgages.

Crystal River.—The sale of this Colorado road, which was to take place on Sept. 8, to satisfy a mechanic's lien of $35,289, in favor of Orman & Crook, has been appealed on petition to the United States District Court, by the State Trust Co. The Trust Co. has asked that a receiver be appointed for the road, and has brought suit against the road to recover $75,000 principal and $83,125 unpaid interest on the bonded debt. On Feb. 1, 1893, the road was bonded for $2,000,000, the company agreeing to pay interest in gold on the bonds at the rate of five per cent. The State Trust Co. alleges that up to Aug. 1, 1896, the interest had been unpaid and a majority of the bondholders had requested the plaintiff to declare due bonds to the amount above stated. The road is about 40 miles long and extends from Carbondale, Col., up the valley of Crystal River, through Pitkin County to the mouth of Coal Creek, thence up Coal Creek to its head.

Fort Worth & Denver City.—Receiver Morgan Jones has stated that this road will pass out of his hands on Oct. 24. It is said that Mr. Jones will be made President of the reorganized company, but that there will be no change made in the officers. After the reorganization several extensions of the road are proposed.

Indiana & Lake Michigan.—The committee of the first mortgage bonds of this company, Morgan G. Bulkeley, Hartford, Conn., Chairman, gives notice that, with the co-operation of more than a majority of outstanding bonds, it has prepared a bondholders' agreement and invites the deposit of bonds thereunder at the Central Trust Company of New York. This road is a part of the Vandalia system, which is controlled by the Pennsylvania.

Lake Park & Columbia River.—This road was sold on Sept. 22 to Stewart Rice, as Receiver of the Washington National Bank, for $13,000 and the bank's judgment; total, $20,000. The company owned no rolling stock, that in use being leased. The road is standard gage and 12 miles long.

Marietta & North Georgia.—It has been announced that the syndicate which bought this road last April, will make a payment of $150,000, on Nov. 1, instead of $100,000, as was at first reported. Something over $900,000 was the price given for the property, and when the $150,000 is paid it will make $542,000 that has already been paid. The property will be reorganized under the name of the Atlanta, Knoxville & Northern Railway, and an extension of the line from Marietta to Atlanta is proposed. Plans for reorganization will be completed by Nov. 1.

Northeastern (Georgia).—The corporation of E. A. Richards & Co., operating this railroad under a lease from its owner, the State of Georgia, has been placed in the hands of a Receiver, the application being made by James P. Harrison, of Atlanta, who claims that Richards promised him a share of the profits from the operation of the road. The Receiver is Mr. Martin Dooly, Superintendent of the road, and a further hearing will be held on Oct. 17 at Athens, Ga. The road is 39 miles long, from Lula, Ga., southward to Athens.

Ogdensburgh & Lake Champlain.—Application was made to the court at Syracuse, N. Y., last week for a Receiver for this road, and on Oct. 2, Justice McLennan granted the order desired, but the name of the Receiver has not yet been announced. The company has defaulted a second time on the payment of the interest on the first mortgage consolidated bonds. This road, 118 miles long, from Rouse's Point to Ogdensburgh, N. Y., has long been controlled by the Central Vermont, and since the insolvency of the latter it has been operated by the Central Vermont Receivers.

Philadelphia & Reading.—Judge Acheson, in the United States Circuit Court at Philadelphia, Oct. 3, confirmed the sale, on Sept. 23 last, of the properties of the Philadelphia & Reading Railroad and Coal and Iron Companies for $20,500,000, made to the reorganization managers. Exceptions presented by Arthur L. Burton, counsel for Joseph E. Smaltz and Francis L. Milne, security holders, were overruled. Samuel Gustine Thompson and E. L. Andrews, representing Morris J. Lippert and Samuel D. Rhoades, respectively judgment creditors for $6,000 and $20,000, also raised objections. For Mr. Rhoades, questions of jurisdiction were raised as to the right of the United States Court in making the decree of sale, and it was contended that the judgment held by Mr. Rhoades is a lien of equal force to that of the general mortgage, and that the general mortgage lien, in marshalling the assets, should be first enforced against the Coal and Iron property. Messrs. Thompson and Andrews claimed that irreparable injury was done their clients by not selling the coal property first. John G. Johnson, appearing for the trustee of the general mortgage, briefly answered the points raised, and said that the entire proceeds realized were insufficient to pay the debts. Judge Acheson, in confirming the sale, said that the matters raised were not new, and that they had been discussed in previous arguments in the litigation.

Providence & Stonington Steamship Co.—This company, now controlled by the New York, New Haven & Hartford Railroad, is to wind up its affairs, the stockholders having so voted at Providence last week. The President of the New Haven road offers to pay the small stockholders $150 a share for their holdings. The boats of this line run from New York to both Stonington and Providence.

Short Line (West Virginia.)—Construction work on this road, between Clarksburg and New Martinsville, W. Va., has been discontinued, pending the settlement of a suit in the Supreme Court of Appeals of the state against the Little Kanawha Valley road. Citizens of Parkersburg have brought suit to annul bonds granted to the road by certain districts in Wood County, and prevent their issue, on the ground that the districts had no powers to grant them. If this suit should be decided against the road the decision would affect the validity of bonds granted to several other roads, including the Short Line.

St. Louis & San Francisco.—The Reorganization Committee, Louis Fitzgerald, Chairman, offers to the holders of the first mortgage 6-per cent. bonds of the Kansas City & Southwestern the right to participate in the reorganization. Bonds must be deposited by Oct. 24, with the Mercantile Trust Company. Each depositing bondholder will be entitled to receive, on completion of the reorganization, for each $1,000 bond deposited, with all unpaid coupons, $650 new mortgage bonds, $400 second preferred stock and $600 common stock of the reorganized St. Louis & San Francisco Company. The offer has already been accepted by more than two-thirds of the bonds.

Seaboard & Roanoke.—The annual meeting of this company, held on Oct. 6, passed off very quietly. It is reported that the active contest for a controlling interest in the stock of the road, which had been going on for several weeks before the meeting, was terminated by the purchase of a sufficient number of shares to control the the election, by James F. Ryan and Gen. Samuel Thomas. Messrs. Ryan and Thomas control the Port Royal & Western Carolina and the Port Royal & Augusta now consolidated under the name of the Charleston & Western Carolina, and it is said that these lines will be operated in harmony with the Seaboard Air Line.

Twenty-eighth Street and Twenty-ninth Street Railroad.—The property of the Twenty-eighth and Twenty-ninth Street Railroad Company, New York City, which has been in financial difficulties for several years, was sold by order of the Court on Sept. 30 to Charles W. Truslow, a lawyer, for $25,000, subject to encumbrances amounting to about $150,000. The tracks of this company, in the streets named, were laid several years ago, but no cars have ever yet been run upon them. The purchase is supposed to be in the interest of the Metropolitan Traction Co.

Underground.—Articles have been filed at Albany, N. Y., consolidating, under the name of the Underground Railroad Company of the City of New York, three companies formed several years ago and holding franchises for the construction of lines between the City Hall and Grand Central Station, with several branches. The old companies were the Central Tunnel, the New Jersey & New York Tunnel and the Terminal Underground. The capital of the new company is $5,000,000. The President is B. F. O'Connor and the Vice President C. V. Sidell. The Secretary is James M. Fisk, of Newark, N. J. The office of the company will be at 54 New street, New York.

Electric Railroad News.

Altoona, Pa.—The Altoona & Logan Valley Electric Railroad is to be sold by the Sheriff of Blair County in the near future. The road was chartered in 1892 with an authorized capital stock of $500,000. The line is over 16 miles in length. The per cent. of operating expenses to total receipts for the 6½ months ending Dec. 31, 1893, was 39; for the year ending Dec. 31, 1894, was 45, and for 1895 was 49.

Baltimore, Md.—The car barn of the Baltimore, Middle River & Sparrow's Point Railway Co., opposite Fairy Grove, was partially destroyed by the cyclone on Sept. 29. The damage will reach over $1,000. The barn was 150 ft. long by 50 ft. wide and made of brick.

Minersville, Pa.—The Minersville Town Council has annulled the franchises of the Schuylkill Electric Railway Co., granted about 18 months ago. The railroad company has failed to extend its line through Hickscherville Valley, as agreed to by the franchise.

Newark, O.—On Oct. 1, Reinhard Scheidler filed a petition in the United States Court asking for the appointment of a Receiver for the Newark & Granville Electric Street Railway Co. on a claim of indebtedness for $30,000. The company operate 13 miles of road, which was chartered in 1888, with a capital stock of $100,000, $73,000 of which has been issued.

New York.—The State Railroad Commissioners have approved the use of the overhead trolley on the Kingsbridge extension of the Third Avenue Railroad (referred to among our construction notes Sept. 25), for a period of 10 years.

Washington, D. C.—Receiver Shoepf, of the Maryland & Washington Railway Co. and the Eckington & Soldiers' Home Railway Co., has filed reports in which he states that the "Belt" line has an excess of $708,309 of the liabilities over the cash value of the assets and the Eckington & Soldiers' Home Railway Co. has an excess of liabilities over assets of $566,992. He urges that the court authorize him to make a contract with H. K. Porter & Co., of Pittsburgh, to furnish compressed-air motors to the road. For further information see *Railroad Gazette* of Sept. 25, p. 678.

The car shed of the Metropolitan Railroad at Third and P street, S. W., on the Ninth street branch, was almost totally destroyed by the cyclone Sept. 29. About 100 new electric cars were in the shed at the time, and 52 of these were seriously damaged. The structure was of brick with a steel roof, with its girders so placed that when they fell some of the cars were cut in halves. The car-house is 80 ft. wide and nearly 300 ft. long.

TRAFFIC.

Traffic Notes.

Through passenger trains over the Lehigh Valley and the Grand Trunk will, after Oct. 15, run through Buffalo.

The steamship Lambert's Point recently sailed out of Galveston drawing 23¼ ft. of water, and the pilot asserts that a vessel drawing nearly or quite 24½ could cross the bar.

The Southern Railway announces a through sleeping-car between Washington D. C., and Galveston, Tex., and another between Jersey City, N. J., and Birmingham, Ala.

John E. Holmes, of Corning, N. Y., has secured judgments against the Delaware, Lackawanna & Western for refusing at 10 different ticket offices to sell him a thousand-mile ticket.

It is reported that the Norfolk & Western is negotiating with the Columbus, Hocking Valley & Toledo, and the Flint & Pere Marquette for a through freight agreement between Wisconsin and the Atlantic Coast.

The receipts of grain at Buffalo in September were 26,960,614 bu., about 35 per cent. more than for the same month last year. The total receipts this season to Oct. 1 were 133,257,460 bu.; to the same date last year they were 87,754,721 bu.

Mr. S. B. Dick, President of the Pittsburgh, Shenango & Lake Erie, has been arrested on a charge of violating the Interstate Commerce law and has been held in $3,000 bonds. The complainant is J. W. Martin, President of the Enterprise Coal Co.

The railroads between New Orleans and Shreveport, La., the Texas & Pacific and the Vicksburg, Shreveport & Pacific, the latter a part of the Queen & Crescent, are engaged in a little freight war. Carload rates on the lower classes have been reduced to 10 and 12 cents per 100 lbs., about 50 per cent. below regular rates.

The Board of Managers of the Joint Traffic Association announces that it has been decided to allow the payment of cartage on import freight at Atlantic ports, when it is forwarded from bonded warehouses, appraisers' stores, or ships' sides within 10 days after arrival; but that no part of such cartage payments shall be used to influence the routing of import or other traffic.

There has been a large increase in the receipts of cotton at Norfolk, and at the expense of Wilmington, Charleston, Port Royal and some smaller ports, during the present season. This is not due to the three weeks' advance in the cotton season this year. The receipts of cotton at Norfolk so far are already in excess of the receipts for the entire season of 1894 and of 1895; and for the season the increase will be fully 100 per cent. The late rate war is thought to have had something to do with it, but the cotton men of Charleston and Wilmington say they do not understand it at all.

Arbitration of Trunk Line Passenger Rates.

J. F. Goddard, Garret A. Hobart and E. F. Leonard, the arbitrators of the Joint Traffic Association, have decided the question of readjustment of passenger fares between New York and Buffalo, as follows:

"That as to trains consuming 11 hours or more between New York and Buffalo, or Suspension Bridge, the differential fares heretofore in effect between those points, and shown in New York Joint Tariff No. 34, effective April 15, 1896, should remain unchanged; that as to trains consuming less than 11 hours between New York and Buffalo or Suspension Bridge via all routes except the New York Central and Hudson River, the differentials heretofore existing (as above referred to) be so reduced as to make the differentials via such trains and lines 75 cents between New York and Buffalo, and Suspension Bridge, and points basing thereon, and that these changes in differentials become effective Nov. 1, 1896.

The arbitrators have dismissed the appeal of the Erie Railroad Company in the matter of readjustment of westbound passenger differentials from New York to Chicago. About a year ago in the adjustment of rates from New York to Chicago certain lines were awarded a rate of $20 and others $18. Two of the lines which were awarded $18 did not make this rate effective and charged $17 instead. These lines were the West Shore and the Lehigh Valley. The tariffs were filed in regular form by all the lines Jan. 1, 1896, these two lines filing the lower rate of $17. The Erie appealed from the decision of the Board of Managers in permitting these rates to stand as filed, claiming that the rates were not those awarded and that the Erie was suffering unjustly as the result. The decision is as follows:

"Without giving any opinion upon the merits of the desired changes in existing tariffs, for the reason that they have not had the discussion and consideration which they should receive before a change is made, the arbitrators decide and award that, inasmuch as the tariffs filed as of Jan. 1, 1896, have been expressly reaffirmed by the companies composing the association, they cannot go behind them to declare that the rulings of the Board of Rulings shall be made effective to change such tariffs.

"The arbitrators therefore dismiss the appeal of the Erie Railroad Company without further action."

Chicago Traffic Matters.

CHICAGO, Oct. 7, 1896.

The prospects for an immediate reorganization of the old Western Freight Association are pretty dim. The presidents and the traffic managers have held several conferences without result. The plan most favored by executive officers is that of the Southwestern Traffic Association. The Wabash will undoubtedly promptly go into any new Association that offers any promise of rate maintenance. The Chicago Great Western is more doubtful. Notwithstanding the absence of any association there is hope of restoration of rates, as the presidents of all the strong roads are inclined to conservative action; though now, as heretofore, it is likely that some road will be found to have made time contracts at low rates.

The Chicago Great Western has reduced hard coal rates, Chicago to Des Moines, to $1.75 per ton. This reduction to apply to all intermediate points. The Rock Island, Burlington & Santa Fe have made a blanket reduction of $1 per ton on coal rates, Chicago to trans-Missouri points.

The Chicago-St. Paul lines, after a three days' conference with the Canadian Pacific and Soo lines, have failed to reach an agreement for a division of all passenger traffic eastbound from St. Paul.

Western roads have extended the territory for reduced rates to Canton, O., to include California. A round trip rate of $60, California common points to the Missouri River, will be used.

The mileage ticket agreement of the Western roads is being enforced to the letter. During September 55 mileage books were taken up on trains. Of these 20 were of the Northwestern's issue. During August 41 were taken up; 72 was the record for July and 10 for June.

Total shipments to the East by lake last week amounted to 91,712 tons, of which 81,119 tons were grain. Total shipments, exclusive of live stock, by all-rail lines, were 63,993 tons, compared with 61,880 tons for the preceding week, an increase of 2,113 tons, and against 79,908 tons for the corresponding week last year. The all-rail traffic was carried in the following proportions:

Roads.	Week to Oct. 3.		Week to Sept. 26.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central	5,573	8 7	8,050	13.0
Wabash	6 491	10 1	8,010	12.4
L. S. & M. S.	7,710	12 1	7,150	11.6
Pitts., Ft. Wayne & Chicago	5,349	8.4	5,884	9.5
Baltimore & Ohio	8,112	12.7	7,182	11.6
Pitts., Cin., Chi. & St. Louis	5,833	9.1	5,216	8.4
Grand Trunk	7,010	11.0	5,566	9.0
N. Y. C. & St. L.	6,583	10.3	7,044	11.8
Erie	7,519	11.7	5,671	9.1
C., C., C. & St. Louis	3,797	5.9	1,902	3.1
Totals	63,993	100.0	61,880	100.0

Of the above shipments, 2,775 tons were flour, 25,379 tons grain, 15,557 tons provisions, 11,101 tons dressed beef, 1,964 tons butter, 1,660 tons hides and 3,227 tons lumber.